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EXPORTS OF A BILLION AND A HALF.

THAT IS THE ESTIMATE OF THE UNITED STATES TREASURY DEPARTMENT FOR THE YEAR ENDING WITH THE PRESENT MONTH—ELEVEN MONTHS SHOW A TOTAL OF $1,385,013,595—IMMENSE INCREASE IN OUTGO OF AGRICULTURAL PRODUCTS.

Exports from the United States in the fiscal year 1901 now about to end will probably reach $1,500,000,000, the highest point ever recorded for a single year in the history of our export trade. For the eleven months ending with May, 1901, the total exports were $1,385,013,595, being double those of the corresponding period of 1889, and $100,000,000 in excess of the total for the eleven months of last year, which broke all previous records. Taking the commerce of the eleven months ending with May of various years as the basis of comparison, the figures of the treasury bureau of statistics show that during the period under review our exports in 1889 amounted to $694,133,804; in 1894, to $834,636,085; in 1899, to $1,130,629,075; in 1900, to $1,285,831,125, and in the present year, as already stated, $1,385,013,595; while for the full fiscal year our total exports give promise of exceeding one and a half billion dollars, as the eleven months' figures only fall $115,000,000 short of that amount, and the monthly exportation of merchandise from the United States has exceeded $120,000,000 since March 1 of this year.

The distribution of our exports during the year among the grand divisions, basing the estimate upon the percentages for ten months already available, will be in about the following proportions: To Europe, $1,155,000,000, as against $1,040,000,000 last year; to North America, $195,000,000, as against $187,300,000 last year; to South America, $44,000,000, as compared with $38,900,000 in 1900; to Asia, $48,000,000, as against nearly $65,000,000 in 1900; to Oceania, $36,0000,000, as against $43,400,000 last year; and to Africa, $26,000,000, as against $19,500,000 in the preceding year. It will be observed that the only decreases will be in our exports to Asia, where unsettled conditions in China have seriously affected trade, and to Oceania, from which Hawaii has been omitted as a foreign country since its organization as a territory of the United States.

To products of agriculture is due the credit for the greater portion of the increase in our exports during the present year. In the ten months for which detailed figures are available, products of agriculture were valued at $811,591,955, and formed 65.53 per cent. of the total domestic exports; last year they amounted to $717,372,746, and formed but 62.21 per cent. of the total domestic exports. For the same period of this year manufactures aggregated $339,310,614 and formed 27.40 per cent. of the domestic exports, while last year they were $352,671,206 and formed 30.60 per cent. of the value of domestic exports. The exports of agricultural products for the full fiscal year will be about $965,000,000, as against $835,858,123 last year, while those of manufactures will be about $405,000,000, as compared with $433,851,756 last year. This decrease in the exportation of manufactures is due chiefly to the following causes: First, the war in China, to which country our exports consisted largely of manufactured articles, and to which market alone our sales in ten months decreased from $13,474,703 in 1900 to $7,706,138 in the present year; second, the transfer of Hawaii from the list of foreign countries to classification as a customs district of the United States, necessitating the omission from our exports of all goods passing between that island and the United States, and thus decreasing by approximately $15,000,000 our exports for the year; and, third, the omission for similar reasons of merchandise passing between the United States and Porto Rico, to which island we sent in the ten months of the present year merchandise valued at $5,611,583, of which sum manufactures formed an important part, cotton goods alone representing over $1,000,000.

FIVE LARGE FREIGHTERS TO COME OUT IN 1902.

It was announced, a few days ago, that the contract for two steel freight steamers of about 6,000 gross tons capacity placed with the American Ship Building Co. by Capt. John Mitchell of Cleveland had been followed by another order for a large freighter to come out next year. Later information is to the effect that the order is for three steamers instead of one, so that the consolidated lake yards will soon have under way five large cargo ships for 1902. The vessels are to be of the same dimensions and about the same power as the six steamers of the Planet fleet (Mars, Venus, Saturn, etc.) recently completed for J. C. Gilchrist and others of Cleveland. It is understood that representatives of Milwaukee coal interests as well as some of the officers of the ship building company are to control the vessels and that they will probably be managed, if not sold while under construction, by W. E. Fitzgerald of Milwaukee. Dimensions and other particulars of the new ships are: Length over all, 366 ft.; length of keel, 346 ft.; beam, 48 ft.; depth, 28 ft.; engines, triple expansion with cylinders of 22, 35 and 58 in. cylinder diameters and 42 in. stroke; Scotch boilers, 170 lbs. steam pressure.

Mr. Warren F. Purdy, manager of the Northwestern Steamship Co. of Chicago, is quoted in Montreal as saying that his company is satisfied with its venture in having ships ply directly between Chicago and European ports by way of the St. Lawrence. He is of the opinion that the Northwestern company will build more vessels of the same kind, but no definite arrangements on that line have been made as yet. Mr. Purdy says he is satisfied that the announcement of the Dominion government that there is 14 ft. of water in the St. Lawrence canals is well founded, as on the voyage of the Northtown, one of the new ships in the Chicago-European service, he held the tape himself and found a minimum depth of more than 14 ft.

Rumors of a ship yard to be started somewhere in Canada by the Clergue interests of Sault Ste. Marie have been widely circulated of late. Mr. Clergue says in a letter to the Review that he is not contemplating the establishment of a ship yard.

ENORMOUS MOVEMENT OF IRON ORE.

A movement by lake of 4,000,000 gross tons of iron ore during June would not be surprising. Shipments of grain are so light that practically the entire lake fleet of general carriers are in the ore trade. They are meeting with delay in port more so than last year, both at the shipping docks and at Lake Erie ports, but the capacity of the lake fleet has been so enlarged of late that the four-million mark in shipments is nevertheless looked for with the end of the month. During the period of heaviest shipments last year the greatest total for one month was but very little in excess of 3,000,000 gross tons. But notwithstanding the present heavy movement of ore, the lake freight market is really stronger than it has been at any time since the opening of navigation. Some of the ore shippers say they fear a congestion of ships at Lake Erie ports before August that may result in a slump similar to that of a year ago, but they also fear an immense grain crop. The big grain crop seems more probable, in fact, than a blockade at the ore docks, and that is the main cause of strength in freights. A rate of 3 cents from Duluth to Buffalo, equal to more than $1 on ore, has already been paid for vessels to load in September next. Heavy sales of Bessemer pig iron within the past few days and some further improvement in iron and steel lines generally are other elements reflecting strength to the lake situation. The monthly statistics of pig iron show that this material is being produced at the rate of 314,000 tons per week and that the consumption is over 320,000 tons per week, or about 16,700,000 tons annually. This surpasses all previous records. Just now coal shipments by lake are also restricted greatly by the pressure of the ore movement on the railroads of Ohio and Pennsylvania. From the Pittsburg district the supply of cars for lake coal has for three or four weeks past been down to about 50 or 60 per cent. of requirements, and this shortage must, of course, be made up later in the season. It may be said, therefore, that in the past week or two business conditions have tended towards the vessel owner's side of the freight market.

POLICY OF THE STEEL CORPORATION.

Judge E. H. Gary, who with other officials of the United States Steel Corporation has just returned from a two weeks' tour of inspection of a number of the plants of the corporation, has expressed himself as satisfied with the trip and says that so far as he can observe there is not a threatening cloud hovering over the iron and steel situation. Judge Gary when asked regarding the corporation's purchases during the past few days of large quantities of pig iron, said:

"Our furnaces have a capacity of 9,000,000 or 10,000,000 tons of iron a year, but as this is not sufficient to supply our mills, it is likely that we will have to buy considerable pig iron—possibly several hundred thousand tons." He said the purchases of raw material are made by the constituent companies and not by the United States Steel Corporation direct; consequently he had no knowledge of the quantity of iron that had been contracted for. When the multiplication of independent iron and steel concerns was called to his attention he said:

"The United States Steel Corporation was not organized with the view of monopolizing the iron and steel business of the country. Competition is natural, and the belief that the organization of the steel corporation would discourage the building of independent concerns was never entertained. Our object is to secure and maintain the best ore properties, equip our mills, furnaces, factories, etc., with the best machinery in the market and keep our plants up to the highest standard of efficiency. Owing to the fact that the consolidation of iron and steel properties has been conducted on a very extensive scale during the past several months I am inclined to believe that construction will not be as pronounced the current year as last."

Judge Gary then explained that the concentration of iron and steel plants would have a tendency to regulate production, and therefore limit construction. For example, a plant that has a capacity of 200,000 tons of pig iron and a capacity of 100,000 tons of finished product would dispose of its surplus raw product to a plant whose output of raw material was not adequate to the capacity of its finishing mills, and vice versa. By this arrangement it will not be necessary for the constituent plants of the steel combine to enlarge their capacity, which they might be compelled to do were they conducting their business independent of any other concern. Mr. Gary intimated that the United States Steel Corporation is not in the market for other concerns. He added that labor appears to be well satisfied, and that no trouble from this source is anticipated. He treated the report that an English syndicate proposed to combine the independent iron and steel concerns of the country as ridiculous.

Printed announcements from the Minnesota Iron Co. and the Duluth & Iron Range Railroad Co., tell of changes in officers made recently to conform with the wishes of officials of the United States Steel Corporation, which now controls the two companies named. New officers of the Duluth & Iron Range Railroad Co. are: F. E. House, president; A. H. Viele, vice president; C. P. Coffin, secretary and treasurer; Thomas Murray, assistant secretary and assistant treasurer. The new men in charge of affairs of the Minnesota Iron Co. are: T. F. Cole, president; N. P. Hulst, vice president; C. D. Fraser, secretary; W. W. Watson, Jr., treasurer; Thomas Murray, assistant secretary and assistant treasurer. The Chicago office of the Minnesota company has been removed to Duluth.

It is quite probable that the Cleveland office having to do with transportation affairs of the United States Steel Corporation will be even more limited in its scope later on than it is at present. The plans seem to contemplate the centralization of transportation offices as well as mining offices at Duluth. Within the next few weeks the entire office force of the Oliver Mining Co. will remove from Pittsburg to Duluth. These mining offices have occupied in Pittsburg nearly the entire eighth floor of the Carnegie building and it is probable the quarters will be given over to the office force of W. W. Blackburn, treasurer of the Carnegie Steel Co.

A STORY OF PLUCK AND ENERGY.

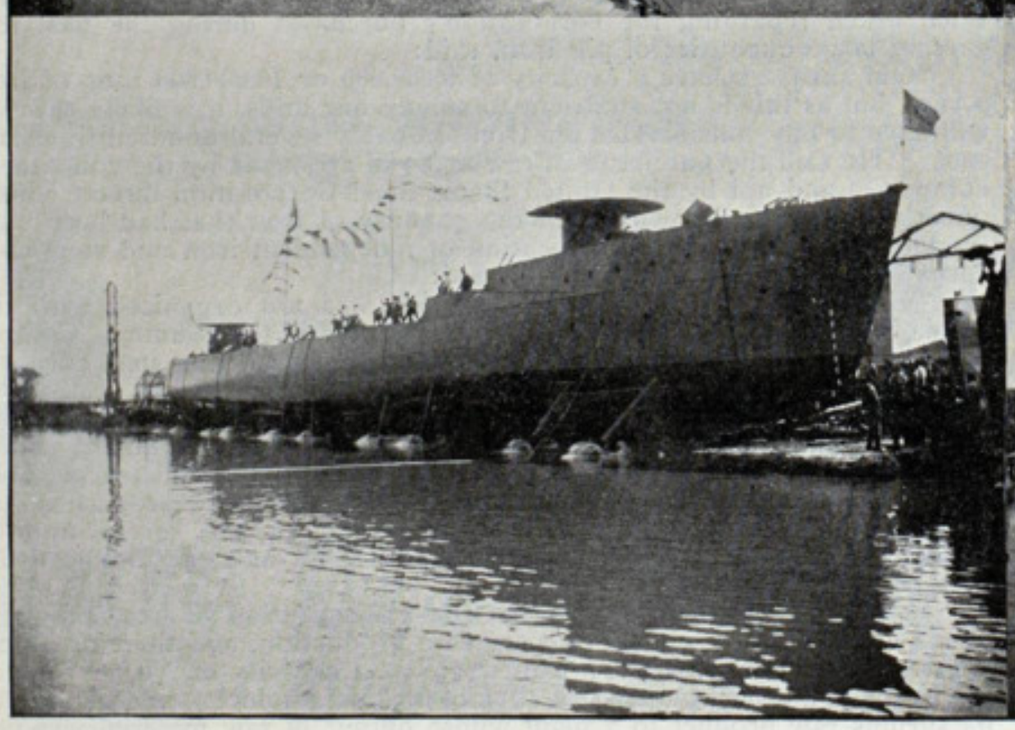
One of the most remarkable examples of American energy and pluck is that furnished by the William R. Trigg Co., Richmond, Va., which has just found it necessary to again increase its capital stock to care for its growing business. In August, 1898, Mr. Trigg, who then had neither ship yard nor machinery, put in a bid for the construction of some torpedo boats for the United States navy. He obtained five contracts with the customary forfeiture clause if the time limit was exceeded. At the time of the award of the torpedo boats to Mr. Trigg in November, 1898, there was at Richmond, and near the center of the city, an old canal with a pier, having a depth of 17 ft. of water above the mean low tide and reached by means of a stone lock. Near it was an old machine shop in a state of dilapidation. With these as a sort of nucleus and a strip of swamp land adjacent as an accessory, Mr. Trigg organized the William R. Trigg Co. and proceeded at once with the work of construction, for there was no time to lose. In spite of this primitive state of things the Trigg company was the first corporation to launch one of the batch of torpedo boats. The torpedo boat Shubrick was launched Oct. 31, 1899, and her sister ship, the Stockton, soon followed. The latter was completed first and accepted Jan. 18, 1901. The speed was 26 knots for 3,000 I.H.P. These boats are 175 ft. long, 17½ ft. beam, and have a displacement of 165 tons.

The company then took up a piece of swamp land on the other side of and bordering on the James river, and proceeded to make dykes, which were temporarily protected from the wash of the river by stretching muslin cloth along the face pinned to the embankment. This new tract comprises forty-five acres. Machinery was added and temporary sheds erected to protect the plant. All this time the building of the boats never ceased. In fact, it just had to go on. Three of the torpedo boat destroyers under construction were to develop 28 knots with 8,000 I.H.P. Their length was 245 ft. with 23½ ft. beam and 420 tons displacement. The torpedo boats and destroyers have twin screws with water tube boilers of the Thornycroft pattern. The boats were launched sideways. As there was no dry dock nearer than Newport News, about 100 miles distant, it was necessary to make some special arrangement for putting the screw shaft in position. This was accomplished by building a cradle under the stern and raising it in the air. The forty-five acres of land acquired will have twenty-five acres devoted to a launching and laying-up basin and twenty acres to shops and the erection of ships. The illustrations which accompany this article show the old yard and the new one in process of transformation.

Machinery in these works is driven by electricity supplied from the power house of the Virginia Electrical Railway & Development Co., about one-third of a mile to the west, which establishment is operated by hydraulic power from the James river. The present ship lock, affording access to the dock, being too small for modern vessels, a larger one will be added. The new lock will be controlled by caissons, such as are used at dry docks. The lock is to be 550 ft. long and capable of taking a vessel of 79 ft. beam. The lock basin is so arranged that vessels can be launched into it. The caissons will be of steel and the pumps electrically driven. The company contemplates adding to its plant a dry dock of 25 ft. draught over sill and capable of taking a ship 550 ft. long. It is proposed to make the dock of concrete, the bottom resting on solid rock, which is to be found at a depth of 15 ft. below mean low water, or 32 ft. below the level of the launching basin. It is expected that a great saving in cost of construction will be effected because of the existence of this solid rock bottom at this level, as it renders rock excavation, bottom lining or sheet piling unnecessary. The operation of this dock will be unusually economical inasmuch as it will be drained for a depth of 17 ft. by gravity, it being necessary to pump less than one-half of the contained water. Construction has not yet begun upon either the ship lock or dry dock. There are very few ship yards on the Atlantic seaboard which have the advantage of fresh water for the storage of vessels, and inasmuch as the ships lie in the water for months between the date of launching and completion the avoidance of the destructive action of salt water upon the hulls is of great value.

THE TRIGG YARD NINE MONTHS AGO.

THE TRIGG YARD THREE MONTHS AGO.



THE DECATUR ON THE WAYS.

LAUNCH OF THE DECATUR.

BALTIMORE DRY DOCK CO.'S PLANT PURCHASED.

A surprise was sprung at the expected foreclosure sale last week of the Baltimore Dry Dock Co.'s plant. It was announced that the syndicate represented by Messrs. J. Quitman Lovell, J. W. Middendorf and Douglas H. Gordon had purchased all the stocks and bonds of the company and had withdrawn the property from sale. The Columbian Iron Works has surrendered its lease of the dry docks and vacated the premises. Possession of the property will at once be taken by the new owners and plans for remodeling the works will be inaugurated. Mr. J. Quitman Lovell will be elected president and Mr. J. Triplett Haxall secretary and treasurer.

The Warren line has contracted with the firm of Harland & Wolff, Belfast, Ireland, for a twin-screw steamer 500 ft. long, 58 ft. beam and 38 ft. deep. The Warren line has now four vessels in the Boston service —the Kansas, Michigan, Sagamore and Sachem.

The Yarmouth Steamship Co. has been sold to the Dominion Atlantic Railway for $260,000. The Dominion Atlantic Railway will take possession of the boats on June 25.

TRIAL OF THE BATTLESHIP ILLINOIS.

Following are the salient points in the trial trip of the battleship Illinois which attained a speed of 17.31 knots and which today has the record of being the speediest battleship in the United States navy. The trial was briefly referred to in the last issue of the Review. The Illinois is speedier by a fraction of a knot than the Wisconsin, her immediate predecessor.

The battleship passed the first buoy at 10:12:03. There was no perceptible vibration in her hull unless one stood on the quarter deck. She displaced a great deal of water forward, which frothed off in a bank of white fully 50 ft. wide, but her stern wave was very small indeed considering the immense displacement of her hull. It was apparent from the start, almost, that the ship would make very fast time, and her progress over the first section of the course, a distance of 6.6 knots, was very closely watched. She passed the second buoy at 10:34:56, having covered the distance in 22 minutes 53 seconds, which showed a speed of 17.3 knots an hour. On the start the ship carried 175 lbs. of steam, but this was gradually worked up until between the second and third buoys she had from 180 to 185 lbs. Her time between these buoys was 23 minutes 20 seconds, showing that her speed here was at the rate of 16.97 knots an hour. However, as the intermediate marks were not placed with absolute accuracy, owing to their distance from shore ranges, there was some question as to the accuracy of the results obtained from them. The old wooden ship Lancaster, on the second mark, was passed at 10:34:56.

On the third stretch on the course the ship showed her greatest apparent speed of the trial, or 17.84 knots. The slack tide may have had something to do with this. The fourth stake boat, the training ship Essex, was passed at 11:20:28, the time for the third stretch thus being the shortest of any in the run, 22 minutes 12 seconds. The run to the fifth stake boat, the training ship Newport, was made in 23 minutes 3 seconds, she being passed at 11:43:31. The indicated speed for this stretch was 17.18 knots. The end of the course was marked by the tug Potomac, and a buoy boat stood by to take up the can buoy there when the battleship should have passed. The mark was passed at 12:06:07. This made the time for the outward run 1 hour 54 minutes 4 seconds and the speed 17.36 miles an hour.

Before passing the last mark the ship's port engines were slowed down, preparatory to turning after the stake was passed. On rounding the stake the battleship was given two complete turns, the first to starboard and the other to port, both at full speed. She turned gracefully, taking only a slight heel, and steering very easily. The water thrown aside from her stern rolled away in a heavy wave, while the suction made on the lee side of the stern caused a rush of clear green brine that made a hissing noise and presented a most picturesque sight. Two turns here were considered sufficient to test the ship on this point. It was found she turned in practically three times her length, with both engines going ahead at full speed, and made the complete circle in 3 minutes.

The start for the home run was made at 12:47:11. It was then flat calm. There was not a suspicion of ripple or swell, and the sun beat down hot on the decks of the cinder-strewn bulldog of the navy wrestling for honors that had been taken by her sister ship in the Pacific not long ago. The home run was made without incident. The ship forged along as steadily as if out for a practice run to give her crew an airing on the wave. The total time for the home run was 1 hour 52 minutes 42 seconds and the average speed for the 33 miles 17.26 knots. The entire time for the run of 66 knots was 3 hours 48 minutes and 46 seconds, and the average speed 17.31 knots.

THE UNITED STATES BATTLESHIP ILLINOIS.

Built by the Newport News Ship Building & Dry Dock Co., Newport, News, Va.

Copyright, 1901, by Samuel E. Rusk, Newport News, Va.

A TIDE RECKONING MACHINE.

A machine that will do the work of thirty expert mathematicians is being constructed by the government in its scientific instrument shop on Capitol Hill, in Washington. It is to be an improvement on an instrument in use in the bureau of the coast survey, which has charge of calculating the tides. This machine will be in a class all by itself as a mathematician. England has one which does a similar class of work, but does not carry its calculations so far. The British instrument was invented by Lord Kelvin. The American instrument was contrived by E. Terrel, an employe of the United States coast survey. The American machine now in use cost $3,500. It stands about 2 ft. high and is 18 in. across. Its half-a-foot of depth is a maze of wheels, pulleys and levers. It does wonderful things. There is a little crank on the lower left hand side, and at a simple turn of that crank the machine will give the answer to a problem involving nineteen separate calculations. The problems it works out are the enormously complicated calculations of tidal variations.

In the year 1903 some ship will be in the harbor of Karachi, India, at the head of the Arabian sea. Suppose the ship arrives at 6:30 in the morning on the first day of October. The captain will have a printed table in his pilot house and in that table he will read that at that particular hour of that particular day of that particular year there is 7 ft. of tide in the bay. By referring to a chart showing the depth of the bay normally he will know just how much water there is for his vessel. The calculation by which it is possible to predict 7 ft. of tide at that place and time was made by the United States government's machine on May 17 last in Washington. The machine owned by the British government is the only other one by which the calculating could have been done; but on account of the enormous volume of such work to be done the two governments try to divide the territory.

Foreign governments have frequently applied to the United States to do some tide forecasting for harbors important to their commerce with the machine invented by Mr. Terrel, which the new one is expected to supersede. They have been quite willing to pay for such work, but as a rule the coast survey has been unable to comply with such requests owing to the pressure of its own work. Dr. R. A. Harris of the coast survey devised the plans for the new machine now being constructed. He has taken suggestions from the two instruments now in existence and hopes to produce one which will combine the good features of both.

The employment of mechanical apparatus for doing work usually performed by the human mind is more extensively seen in the government scientific departments than any other place in the country. The multiplying and dividing machine, for example, is a great saver of time and mental labor, not to mention its absolute accuracy. The machine declines to make mistakes, and if the operator tries to make seven go into six will ring a bell in protest. Practically all the adding in the government's coast survey work is done by machines. Where the column contains three-quarters of a million figures, as frequently happens in the tide computations, the saving in mental effort is very considerable.

A chart of Georgian bay, entire, on one sheet, from survey of Com'dr Boulton of British admiralty, will be sent to any address, postpaid, at $1.25; regular price $1.75. Size of sheet 3x3 ft. Chart of Mid'and section 3x4 ft., same survey at same price.

A British admiralty chart, Midland section of Georgian bay, will be sent, postpaid, to any address for $1.25; regular price $1.75. Size of sheet 3x4 ft. The Marine Review Pub. Co., Perry-Payne building, Cleveland. Chart of the whole bay on one sheet at the same price.

CITY OF ERIE-TASHMOO CONTEST.

Some comment was occasioned by the fact that in an official account of the performance of the side-wheel steamers Tashmoo and City of Erie, during the recent speed contest on Lake Erie, which appeared in the last issue of the Review, cards taken from the engines of the City of Erie on the day of the race were published, while those from the Tashmoo were, as noted, taken on previous trials of that vessel. Mr. C. B. Calder of the Detroit Ship Building Co. makes the following explanation:

"We failed to get a single card on Tashmoo the day of the race. The best we could do was to publish previous cards at 39 revolutions and figure the power at 40.08 revolutions. We are absolutely certain that the power given, 3,400, is within 1 per cent. of the actual. The cards published show the actual distribution of steam in the Tashmoo cylinders on that day. We were exceedingly sorry that we did not have for publication cards taken during the race, and sorry, too, that we are at great loss on our own account on that score. Failure in this regard is a disappointment to all of us. Our Mr. Mattsson reports that it was impossible to get cards during the race, owing to so much steam and water in lower engine room. The paper would not stay on the drum of the indicator long enough to get a card."

FIRE-PROOFED WOOD.

The use of fire-proofed wood in vessels of war is steadily increasing. The United States navy has used fire-proofed wood for over six years. There are now over seventy-five United States warships containing wood treated by the "electric" fire-proofing process. Recently some of the wood treated by this process some five years ago was taken from the torpedo boat Winslow and when tested was found to be first-class in every respect—fire-proof in all its parts as much so as when first installed in the vessel. The United States government was first to use fire-proofed wood for warships and the example thus set has been followed by Great Britain, Denmark and the other European powers. The Russian government has been particularly active in using wood treated by this process, and when the magnificent Russian cruiser Variag was building at the works of the Wm. Cramp & Sons Co., Philadelphia, all woodwork was ordered fire-proofed before entering into the construction of the ship. At the present time all of the wood required for the huge Russian battleship Retvizan is being treated at the works of the Electric Fireproofing Co., Nineteenth street and East River, New York city. This is the largest battleship ever built in this country and will be one of the most powerful afloat.

Wood treated by the "electric" process has been used throughout the construction of several of the largest sky-scrapers in New York city, this process being the only one thus far approved by the department of buildings in New York for use in fire-proof construction, in accordance with section 105 of the new building laws.

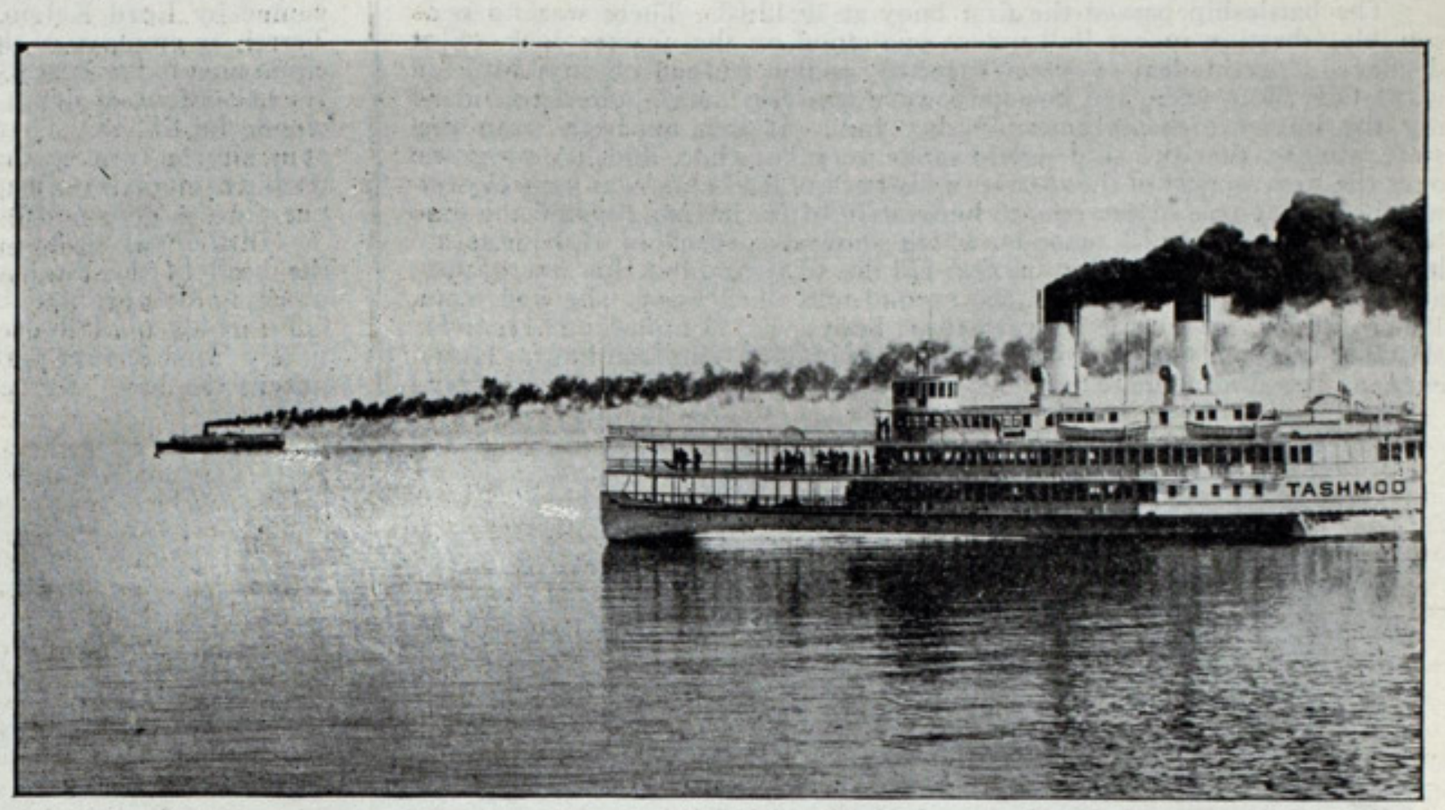
TRANSPORT INGALLS TIPS OVER IN HER DOCK.

An unusual accident happened Friday to the transport Ingalls in a balanced dry dock at the Erie basin, owned by the New York Dry Dock & Repair Co. The transport tipped over in the dock. One life was lost and twenty-five men were injured. One of the injured men has since died. The exact cause of the accident is not as yet known, but will doubtless be determined in a day or two. It is supposed that the bilge blocks under the vessel were not properly adjusted. When the dock was fairly empty it was discovered that some of the shoring timbers, which extended from

TRANSPORT INGALLS AFTER THE DRY DOCK ACCIDENT.

the sides of the dock to the vessel, were defective. The Ingalls began to tilt to the west. Cables were then attached to the capstans and passed around winches on the starboard side of the deck. Then the engines were started and an attempt was made to put the ship in an upright position by main strength. The big vessel was swung past the perpendicular so that she had a slight list to starboard. Then one or more of the bilge blocks slipped and the ship heeled over slowly on the starboard side. The first warning that came to the workmen was the snapping of one of the starboard shoring timbers amidships. As the vessel settled over other shoring timbers snapped and the workmen, who were clinging to her sides, began to scream with terror. Second Officer Gray of the steamship Madiana, which was in the dry dock on the west side of the Ingalls, was one of the very few men who witnessed the accident, and this is what he saw:

"The transport was slipping over to starboard slowly but surely. There was a tremendous crashing and crunching of breaking timbers. The men on the under side of the ship as she heeled were screaming wildly for help. Those on the side toward us, who were, comparatively speaking, in no danger, were hanging on for their lives and making very little noise.



THE FINISH AT ERIE OF CITY OF ERIE-TASHMOO RACE.

Before the side of the transport struck the dry dock the men began to pour out of her hatchways in a stream. Once out they ran wildly up and down the port rail scrambling along the sloping deck as best they could, and striking out fiercely whenever they came in one another's reach. There were two men on the starboard side of the dry dock when the ship began to tip over, and I was sure some of the rigging or masts or the smokestack would fall upon them and crush them. They ran out on the deck as fast as their legs would carry them, and the last I saw of them they jumped from the end of the dry dock into the basin and swam out to a tug. To the east of the dry dock in which the Ingalls rested was the steamship Iona. The dry dock in which the Iona rested was high out of the water, and the western side of it was caught fair and square by the foremast of the Ingalls. The foremast broke, but not until it had made a wreck of the other dry dock, and had cut into the Iona's top hamper. The smokestack of the Ingalls caught on the edge of her own dry dock, buckled and at length pulled out from the deck, rivets and all."

Mr. W. D. Dickey, general manager of the dry dock, made the following statement: "There were 3 ft. of water over the dry dock when the accident happened. We do not know the cause of the trouble and will not know until an investigation is made. The dry dock is in good condition, as the timbers used for shoring up the vessel were sound and strong. It is not true that the dock was old and unsafe. Only three years ago it was almost rebuilt at a cost of $30,000. Larger vessels than the Ingalls had been in the dock and no accident happened until yesterday."

The work of raising the Ingalls is now being undertaken by the Merritt & Chapman Derrick & Wrecking Co. Mr. John N. Robins, manager of the dry dock, has given strict orders to allow no one within the grounds of the company.

SHIP YARD NOTES.

W. A. Boole & Son, ship builders and engineers of San Francisco, writing to the Review, say: "We have just completed a four-masted barkentine, the Lahaina, now ready for sea and of the following dimensions: 245 ft. over all, 210 ft. keel, 41 ft. 8 in. beam and 17 ft. depth of hold. We now have on the stocks, ready for launching, the steam schooner Apprentice of the following dimensions: Length from after side of propeller post to rabbet on stem on load line, 137 ft.; beam, molded, 34 ft.; depth of hold, 11 ft. The tonnage of this steam schooner will be in the neighborhood of 400 tons. We are now laying the keel for a four-masted barkentine to measure 210 ft. on the keel, 245 ft. on deck, 41 ft. beam and 17 ft. depth of hold."

The Atlantic Works, one of the largest marine engine concerns in New England, has been buying the stock of the East Boston Dry Dock Co. until it has obtained a majority. The dry dock company's property has an extensive harbor frontage in East Boston and the company's capitalization is $100,000. The property is located next to that of the Atlantic Works and the latter concern, needing enlarged facilities, took the opportunity to purchase a plant so convenient.

It has been persistently rumored of late that the Bath Iron Works, Bath, Me., contemplate removing their plant to Chester, Pa. The rumor probably has its base in the fact that the Bath Iron Works is to be one of the constituent companies of the United States Ship Building Co., if that company is organized. The company is at present hampered in Bath by its inability to get sufficient land to care for its rapidly growing business, and possibly under the circumstances might seek a site elsewhere.

The Crescent Ship Yard, Elizabethport, N. J., launched the submarine boat Fulton last week. She is a trifle larger than the Holland. Every detail in equipment and motive power will be perfected in this boat and its efficiency proved. Work on the other boats, however, is being rushed night and day.

Harland & Wolff of Belfast will soon have ready for launching a freight and passenger steamer similar to the White Star liner Celtic

SHIP BUILDING IN CANADA.

EVERY TOWN IS EAGER TO SECURE THE ESTABLISHMENT OF A SHIP YARD—A CAREFUL REVIEW OF THE SITUATION.

The Boston Transcript publishes the following article from its Halifax correspondent, upon ship building in the maritime provinces:

Canada has yet to build its first ocean-going vessel of steel; and as yet no large vessel, nothing corresponding to the freighters built at Cleveland or other lake cities of the United States, has been built in a Canadian lake port. It will not, however, be for lack of government aid if there are not soon several large ship building yards on the Nova Scotia and New Brunswick coast; and it will not be for lack of agitation if the dominion government is not before long giving bounties for steel tonnage built on the coast and on the lakes. In the maritime provinces the ship building fever is now running high. It had its origin in the installation of the great plant of the Dominion Iron & Steel Co. at Sydney, Cape Breton. Sydney, with the coming of the steel plant, has in eighteen months increased its population from 3,000 to 15,000; and an erstwhile small and decaying country town has now become the leading industrial center of Nova Scotia. Sydney's proximity to bituminous coal and its famous harbor have combined to give it its new preeminence. Every coast town in Nova Scotia cannot become a great center of the steel trade, or even a great shipping port for coal; but nearly every town in the province with a frontage to tidewater conceives that it is admirably adapted for the site of a steel ship building plant; and never in the history of the maritime provinces were there such opportunities for promoters and bonus schemers as there are today, all arising out of the attempt to boom steel ship building.

The steel plant at Sydney is but partially complete. Only one of the blast furnaces is at work. It will be October or November before the blooming mill and the rail mill are in operation. At present it is no part of the plan of the steel company to make structural steel such as is required for ship building; and there is today nowhere in Canada a steel plant equipped for this work. In spite of this fact, the coast towns of Nova Scotia are possessed with the idea that the installation of the furnaces and rail plant at Sydney must at once bring steel ship yards in their train; and at the last session of the Nova Scotia legislature so many towns applied for power to bonus steel ship building yards that the government carried through the legislature an act giving any municipality power to make a grant in aid of any such enterprise.

Under the new law, after a favorable vote of the electors, any municipality can grant a bonus not exceeding $100,000 for the establishment of a ship yard, and also can free the plant and the earnings of the company from municipal taxation. Any municipality in Nova Scotia can now avail itself of these powers; while for Halifax a special law was passed under which this city can grant a bonus of $100,000, and can pay tonnage bounties to the amount of $25,000 for four years. The requirements of the Halifax act, however, are more exacting than under the general law; for the Halifax bonus can be paid only in respect of a plant equipped to construct not less than 20,000 tons of shipping annually. Halifax already possesses a magnificent stone dry dock to which the city, the provincial, the dominion and the imperial government all contributed, and at which for years past warships belonging to the British North Atlantic squadron have been docked; and it is felt that the existence of this dry dock, the finest stone dock on the Atlantic coast, should be a factor in bringing business to a well equipped ship yard here.

The boom has not been confined to Nova Scotia. It has extended to New Brunswick, and at the present time the municipality of St. John is negotiating with the imperial government and with the dominion government for subsidies for a dry dock; and with the dry dock undertaking well started, it is expected that St. John will also have a steel ship building yard. Half a century ago, the maritime provinces built tonnage for service all over the world. But these were the days of wooden sailing ships; and at that time and until so much of the world's carrying trade passed to iron and steel ships, vessels were in building on nearly every creek in Nova Scotia and New Brunswick. Timber was cheap, and the ship building yards came into existence at scores of places on tidewater which happened to be in proximity to timber. Once again Nova Scotia, through the development of its mineral resources, is to be in command of the material that goes to the makeup of modern fleets. Steel is soon to be made in Cape Breton cheaper than anywhere else in the industrial world, and with the coming of cheap steel it is perhaps only natural that Nova Scotia should see an opportunity of regaining some of its old preeminence in the maritime world, and be even a little over eager to push its new opportunities.

Great Britain for many years to come will of necessity be adding continuously to her war navy, and there is little doubt that if Halifax, or Sydney, or St. John should become possessed of a well equipped ship yard, work for the imperial government would soon find its way to this side of the Atlantic. The policy of the imperial government as regards the building of the navy has for many years past been to divide the new work between the government yards and those of the British ship building companies, so as to secure the establishment and maintenance in a high degree of efficiency of the largest number of plants at which war vessels can be built. It would be in line with this policy to give Canadian yards a share in the new war tonnage; and at the present time, when the colonies are nearer in feeling and sympathy to Great Britain than they have ever been, and when the imperial spirit is so strong and dominant all over the empire, such a policy would receive strong popular indorsement in Great Britain.

There are on the lakes today three Canadian ship yards at which torpedo boats, torpedo boat destroyers, and even large-sized gunboats could be built; and with the deepened St. Lawrence canals there are no obstacles to the bringing of such vessels from the lakes to tide water. There is, however, a convention between the United States and Great Britain which would prevent additions to Great Britain's war fleet from being built at Canadian lake ports. No such obstacle stands in the way of ship yards on the coast; and it is exceedingly probable that if ship yards in Nova Scotia or New Brunswick attained the standard of excellence required by the admiralty, they would seldom lack some government work. But until structural steel plants are established in Canada, the maritime provinces could not meet the competition of the Clyde and the Tyne, Tees and Wear. Vessels now built on the Canadian lakes are mostly of steel imported from Pennsylvania. Public opinion in England would never tolerate American structural material in British warships, although within the last two years several hundred thousand tons of Pennsylvania steel have gone into vessels built at Glasgow and at Belfast for Great Britain's mercantile fleet.

The movement to boom ship building in the maritime provinces has up to the present been confined to municipal bonuses, municipal tonnage bounties and tax exemptions. The movement for dominion tonnage bounties, to which I referred at the outset of this letter, has had its origin in Toronto. It may be said to have arisen as the direct and speedy outcome of the deepening of the St. Lawrence canals. Before the canals had their present depth of water and their enlarged locks, it was a work of difficulty and much cost to get a Clyde or Wear-built steamer from the St. Lawrence to the lakes. The cost and the delay were so great that had there been no deepening of the canals the ship yards on Lake Ontario and Lake Huron might have been free from any competition from Great Britain. Now, however, with 14 ft. of water in the canals, British built vessels are easily passed from the St. Lawrence to the lakes; and in 1900, the first navigation season during which the deepened canals were available, a fleet of British built steamers was brought out for the ore carrying service between Michipicoten bay, Lake Superior, and Midland on Georgian bay, where in December last a new pig metal making plant using Ontario ore was put into blast.

The Canadian lake ship builders are now disturbed by this new competition from Great Britain, and have recently begun an agitation for dominion bounties to offset it. In 1897, when the preferential tariff lowered the duties all round on British imports, the protection hitherto afforded to Canadian iron and steel plants was reduced. But to offset this change the Laurier government liberally increased the bounties on pig metal and steel ingots, and thus put the Canadian manufacturers in a better position, both as regards American and British competition, than they were in before the introduction of the preferential tariff. Canada's lake ship builders now contend that they are as much entitled to government aid in meeting the new competition as the manufacturers of iron and steel were in 1897, and they are demanding tonnage bounties sufficiently liberal to prevent British ship builders from underselling them. They are seeking to persuade the government that this help will not be needed for any long period. They point to the development now going on in the iron and steel industry at Sydney and at Sault Ste. Marie, Ont., where a plant even larger than that at Sydney is to be installed. When these plants are at work it is affirmed that structural steel will be obtainable by Canadian ship builders as cheaply as ship builders in Great Britain obtain their plates, channels and angles; but until these conditions are an actuality, and the ship building industry has established itself, they contend that they are as much entitled to protection by bounties as are the Canadian manufacturers of pig metal and steel ingots. So far this movement is confined to the lake ports of Ontario; but it will not be long before the maritime provinces associate themselves with it, and unless the Laurier government is prepared to turn its back on its protectionist and bounty record, on the record which it has made since 1897 in connection with government aid to the iron and steel industry, it will find it difficult to withstand the new movement.

THE LOAD LINE QUESTION.

The United States steamboat inspection service recently adopted a new form of certificate of inspection. The blank form was of a general kind, intended for the seaboard as well as the lakes, and contained a space for a load line—a limit of draught for the vessel inspected. The local inspectors at Buffalo concluded that it was their duty to fill out the whole thing and in a certificate issued to one of the Corrigan vessels of Cleveland not only fixed a load line but also specified the number of licensed officers, crew, etc. The matter was taken up by officials of the Lake Carriers' Association and it was soon proven that there is no authority whatever in law for the establishment of load lines for lake vessels. Capt. James Stone, supervising inspector of the Buffalo-Cleveland district, says of this incident in a letter to the Review:

"The load line marked in blank space on certificate of inspection by local inspectors on the lakes is simply the result of a wrong interpretation of what is meant by seagoing steamers. Since the great lakes are not classed among waters known as the high seas (except perhaps in cases involving criminal acts) the term 'seagoing' does not apply to our lake steamers, and all local boards on the lakes have been so instructed. And even upon waters where the load line act governs it is provided that 'the owner, master or agent shall determine where such draught limit shall be placed, and the inspector note his decision upon the certificate, and it shall be unlawful to load deeper than indicated on certificate.'

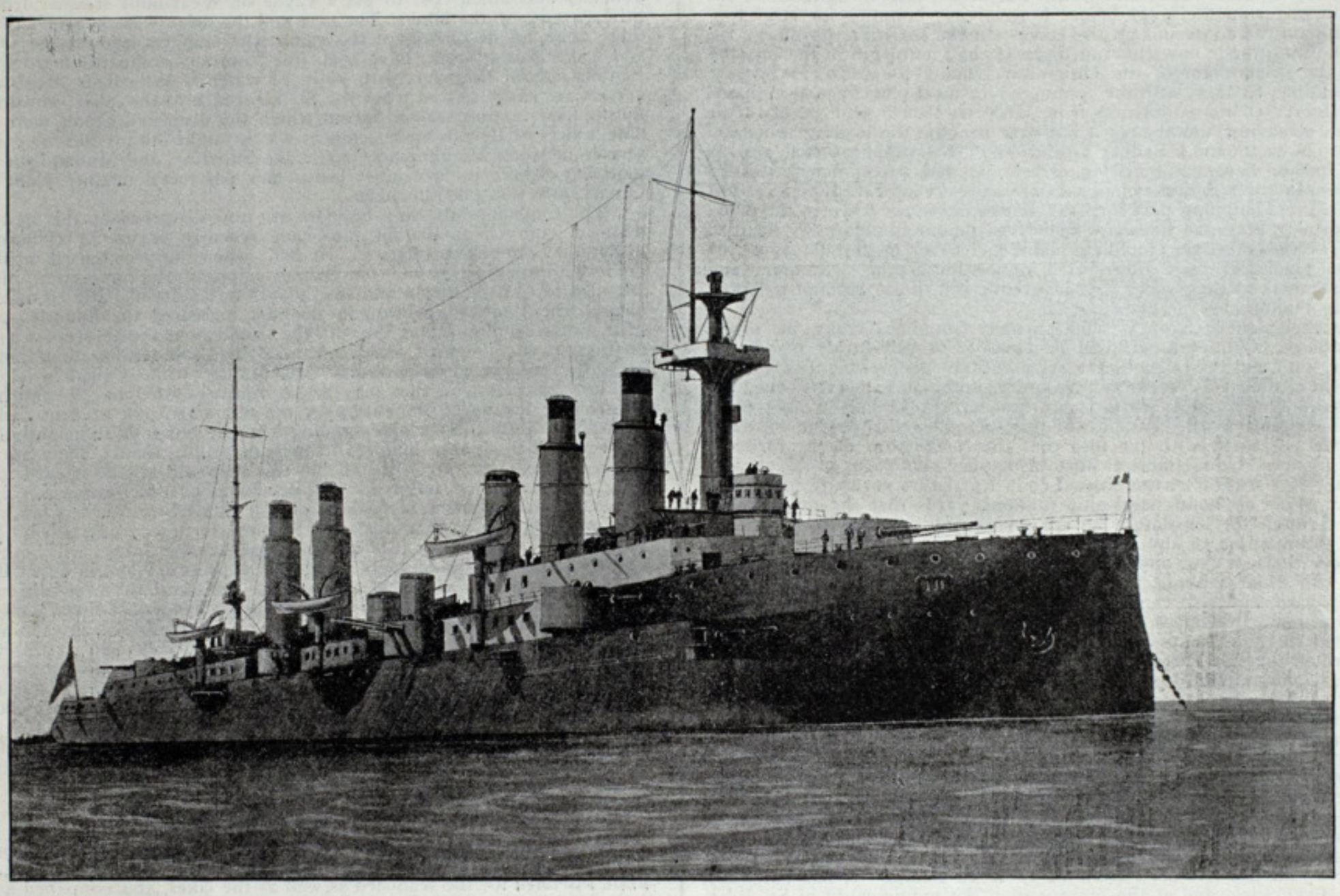
"Authority to determine the number of licensed officers and crew to man a steamer efficiently for the trade and route in which she is to engage has caused some inquiry. Such authority is vested in the local boards of inspection by rule 9, section 8, rules and regulations, 4463 and 4477 United States revised statutes. This authority is never arbitrarily enforced except in cases where small steamers engage in a short trade, but nevertheless a trade requiring more hours continuous service than one pilot or engineer could stand with safety to life and property—where the necessity of a prompt and lawful decision is recognized at once. Were there no authority conferred on anyone by law to determine what is or is not a sufficient number of officers and crew and an accident occurs in consequence of navigating short-handed, there would be good reason for the public to criticise the lawmakers for laxity in caring for the lives of those who travel by water, either as passengers or seamen."

A statement announcing the sale of 160,000 shares of the stock of the Bethlehem Steel Co. has been mailed to the stockholders. The shares sold were owned or controlled by four directors. The purchaser is Chas. M. Schwab, president of the United States Steel Corporation. It is understood that the stock will shortly be transferred to Vickers' Sons & Maxim at a price that will net the purchaser a handsome profit. It is said that the negotiations to purchase the Bethlehem plant on behalf of the ship building combine did not fall through over the question of price but on the refusal of the proposed purchasers to take over the minority holdings at the same figure.

TYPES OF CRUISERS CONTRASTED.

A DISCUSSION REGARDING THE RELATIVE MERITS OF THE FRENCH GAMBETTA CLASS AND THE BRITISH DRAKE CLASS—BIG MODERN CRUISERS VERSUS BATTLESHIPS.

The Engineer of London has devoted a large part of two issues of recent date to a description of the Leon Gambetta class of French armored cruisers in contrast with the Drake class of British armored cruisers. The contrast is of interest because the two classes may be compared with the Maryland type of cruiser now building for the United States navy. It will bring the French and British classes clearer to the eye by proceeding at once to give their principal dimensions and features:



FRENCH ARMORED CRUISER GAMBETTA.

	Gambetta.	Drake.
Displacement, tons	12,416	14,100
Length (p.p.), ft.	476	500
Beam, ft.	71	71
Draught (mean), ft.	26¼	26
Armament, main	Four 7.6 in.	Two 9.2 in.
Secondary	Sixteen 6.4 in.	Sixteen 6 in.
Tertiary and small	Twenty-two 3-pdrs. two 1-pdrs.	14 12-pdrs., 3 3-pdrs., 8 maxims.
Torpedo tubes	Two submerged, three above water	Two submerged.
Indicated horse-power	27,000	30,000
Speed (maximum), knots	22	23
Boilers	Normand	Belleville
Screws	Three	Two
Coal (normal), tons	1320	1250
Coal (maximum), tons	2100	2500
Armor, main belt	6—4 in.	6—3 in.
Upper belt	5—3 in.	6—3 in.
Main turrets	6 in.	6 in.
Hoists, etc.	5 in.	6 in.
Secondary guns	6 in. turrets (six) and bases, 4 in. casemates	6 in. casemates
Deck	2½ in.	4 in.
Conning tower	8 in.	12 in.
Bulkheads	6 in.	8 in.

Discussing different features of these two cruisers, which compare favorably in a general way, the Engineer says:

"For her extra weight the Drake gets a knot more speed and somewhat thicker armor, though this has little significance comparatively. A big high explosive shell will smash a 4-in. plate as easily as a 3-in., while so far as the guns carried by the ships are concerned, 5 in. of armor are just as efficacious as 6 in. In the protection of the water line, lower deck and big guns the two ships are practically identically protected; that is to say, no one can definitely call one better than the other for fighting purposes. The radical difference lies in the distribution of the secondary armament. That of the Drake is in four main groups, that of the Gambetta in six. Each Drake group consists of four guns, while the Gambetta has four groups of three and two of two. A shell from the main guns in either ship if it knocked out one gun of a group would probably knock out all, and against such fire the Gambetta stands first. Against smaller guns the reverse rather obtains, for all the Drake's guns are isolated, while twelve of the Gambetta's pieces are in pairs.

"In regard to high explosive shell attack from secondary guns the Drake may expect to put out a couple of Gambetta secondary guns with her secondaries sooner than she will lose a couple. This is the elementary deduction. It is colored, however, by various facts, the relative values of which are not precisely known. It is not known what risk of being put out of action is run by the offside casemates of the Drake, which have thin backs. It is not known how easy or how difficult it may be to jam with shell fragments the minor turrets on which the French pin such faith. Consequently an absolute comparison is quite impossible, there being too few axioms to allow of a certainty. Granting this, however, and allowing credit to the most generally accepted theories, the two ships are very much alike, with a balance in favor of the Gambetta on account of her double turrets. The guns in these will be on the Canet system of twin mountings, which ensures that the shell from one will burst at nearly the same spot as the shell from the other, thus securing some of those advantages peculiar to the old battery, and distinctly absent in the single casemate system. That the 164 mm.—6.4 in.—French guns are more powerful than British 6 in. does not, in our opinion, count for much; cases in which men at the secondary guns are concerned with penetration of armor will be very few against modern ships. At the main guns men may have to think of it fairly frequently, though even here far less than many people suppose. As things stand today, armor has beaten the gun, not because it is absolutely superior so much as because the gunner is beginning to think that penetration is no longer all important. Armor does not protect gun muzzles; indeed, it endangers them by bursting shell near the muzzles.

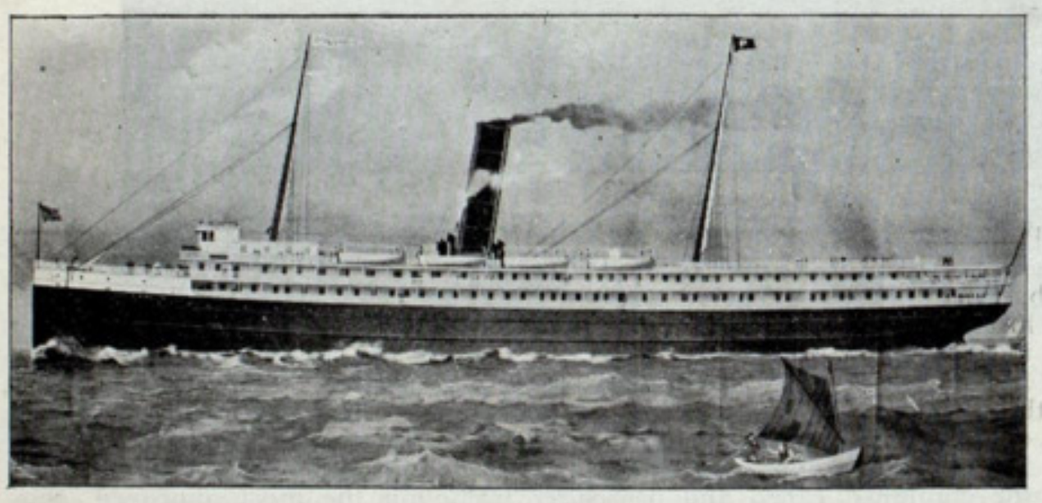
"To resume. The secondary turrets of the Gambetta are mounted on stout armored bases; they are, in fine, towers, with their foundations secure behind an armored wall, and so should stand the crash of heavy shell below them very well. As for the big guns, the single 9.2 of the Drake may be put on a par with the two 7.6 pieces of the Gambetta. Its shell is twice the weight of the French shell, and since shell effects do not follow a scale in proportion to weight, probably three times as destructive. Its rate of fire is very good, so that the matter becomes chiefly a question of quantity versus quality. For shell attack only the pair of lighter guns would be preferable; but along that line of argument four 6.4's would be better than two 7.6's. Circumstances must arise in which the power to deal a heavy armor-piercing blow will be of great value. So the Drake cannot be held inferior to the French 'reply' on this score. Yet, taking things all in all, the Gambetta is probably rather the better ship, and, indeed, having been designed after and against the Drake, she should be. The principal advantage lies, we suspect, in the disposition of the secondary guns, and we are by no means sure that the advantage is not greater than is supposed. The comparison would be incomplete without reference to the tertiary guns. Here it is a case of the Drake first and the other ship nowhere. The 3-pounder is not likely to be much more effective as a destroyer stopper than the service Lee-Metford bullet as a horse stopper; while the 12-pounder should be comparable to the Dum-Dum or something better. Given that each is attacked by a destroyer, the Drake is infinitely more likely to survive the encounter. To be sure, a destroyer's chances of getting the opportunity are not many; they would, indeed, be mostly chance meetings, and so an anti-destroyer armament is not a prime necessity to a cruiser whose warfare—if she sticks to her metier—will be almost entirely with her own kind.

"Whatever conclusions we may come to as to the relative values of the Drake and the Gambetta, one fact must stand out prominent, and that is that she is a very fine example of the armored cruiser. In her, too, French

naval construction has made a great advance on previous efforts. It goes without saying that this country will have to produce a reply to the Gambetta; and we feel safe in prophesying that the reply ship will resemble the Gambetta far more than the Drake or any other vessels in the British navy now do. We shall, indeed, be surprised if small turrets for secondary guns in pairs do not form a feature of all, or most, of the future designs for ships of the British navy. What is more, we shall expect to find it associated with an armored battery, instead of isolated casemates."

The Gambetta's armor and armament is described as follows: Two turrets, balanced fore and aft, each carrying a pair of 194 mm. (7.6 in.) guns, protected by 6 in. of hardened steel, and supported by armored pillars, inside of which are the hoist and machinery. Upon the sides, as widely apart as possible, are six similar turrets on the upper deck level, carrying each a pair of 164 mm. (6.4 in.) guns. On the main deck, just forward and just aft of the end 6.4 in. turrets, are casemates 4 in. thick, each mounting a single 6.4 in. gun. The upper belt protects the bases of these and save for a small unprotected piece right aft this belt is continuous. The 3-pounders are distributed about the main deck and upper works. Following the now universal rule in the French navy, these will all be without the absurd little shields that still cover portions of British Hotchkiss guns, and serve no purpose beyond ensuring the burst of any shell that chances to touch them.

"The characteristic French cruiser is, or was, small," says the Engineer, "but our present concern is with the monster cruisers intended for use with, or as battleships, should occasion require. It is just this possibility that has led many capable experts to attack the big armored cruiser. This school advocates the small cruiser, which must perforce do cruiser work; the big one, they say, will, in practice, prove to be only a weak battleship. However, France is a land of many schools, and one of the most powerful of these argues that cruisers are all that France needs. Attacking battleships, they can use the torpedo—which makes all ships equal—attacking cruisers, the gun. It is all very pretty, but it is usually based on an imperfect conception of what a well-handled modern big gun can do. Fate has been unkind to big guns. At Yalu, the excellent 12.5 Canet pieces in the Matsushima class were out of order and fired slowly; the old 12 in. Krupps in the Chinese ships lacked shell to demonstrate their powers on unarmored ships. At Santiago the Americans had no modern big pieces, and the Spaniards seemingly had no ammunition for those 11-in. guns that the American officers admired so much after the battle. A gun like the 12-in. Mark IX. can certainly fire once every two minutes in battle, and as each battleship carries four, that means a rate of two a minute. If a battleship, even six knots inferior to a cruiser in speed, steams away it will take the cruiser twenty minutes to close 4,000 yards, which means twenty shots from the after barbette under the most favorable shooting conditions. We cannot help thinking that we should feel a good deal safer behind the big gun than in the cruiser, even if the latter were able to assure herself with the delightful little theory propounded by the gunnery expert in the new Naval Annual, as to how long it will take a 6-in. quick-firer to smash a big gun muzzle if it aims at it from 3,000 yards. In point of fact, we do not see how the cruiser can avoid finishing her trip at the bottom of the sea. For practical purposes all big guns nowadays are quick-firers. Wherever and however a 12-in. projectile hits no ship is likely to be the same after it as she was before, unless as happened at Santiago de Cuba, an unarmored part is hit. But the modern cruiser, with any amount of thin armor over her, is an ideal bursting target for 12-in. shell."



MODERN ATLANTIC COAST FREIGHT AND PASSENGER STEAMER HORATIA HALL OF MAIN STEAMSHIP CO.'S FLEET.

REMARKABLE STORY REGARDING CHARLES M. SCHWAB.

If a story from Cincinnati, which has been published in all the leading newspapers, is to be credited, extraordinay circumstances were encountered by J. Pierpont Morgan when he set about the organization of the billion-dollar steel trust, and one incident in particular reveals Mr. Charles M. Schwab in a most remarkable capacity. Recently Mr. Morgan was called upon to express his opinion of the sincerity of Mr. Carnegie's statement that he did not want to die rich. This is what he is reported to have said:

"I believe that Mr. Carnegie is absolutely sincere on that point, and I think his actions prove it. Let me tell you about one thing he has done. When the organization of the United States Steel Corporation was about to be effected I met Schwab at my office to discuss the status of the Carnegie holdings. It was then expected that Mr. Schwab might be selected as president of the corporation, but there was no definite conclusion on that point. Mr. Schwab astounded me by telling me that he was receiving a salary of $1,000,000 a year as president of the Carnegie companies. 'I know no man can be worth that much salary,' said he, 'but I'll tell you how it happened that such a salary was given me. About a year before the reorganization of the Carnegie interests, or two years ago, I was offered astonishingly liberal terms to sever my connection with the Carnegie interests and take charge of some large manufacturing interests in Germany. I was receiving what I regarded to be a liberal salary from Mr. Carnegie, but it was small as compared with what the Germans offered me in the way of salary and interest in prospective profits. Nevertheless I declined the German offer in order to continue my connection with the interests I had been so long identified with. I said nothing to Mr. Carnegie about the matter. However, it came to his ears, and one day I was astounded to receive from him a blank contract which needed only my signature to assure me of a salary of $1,000,000 a year for five years. I went to see Mr. Carnegie about the matter, and said in my opinion it was impossible that the services of one man in any business, however profitable, could be worth $1,000,000 a year. He replied that that was not the point; that his chief purpose in life was to distribute his wealth according to the plan he believed proper. He insisted upon my signing the contract, and that's how I came to receive a salary of $1,000,000 a year.'

"I told Mr. Schwab," continued Mr. Morgan, "that I had never heard of any such salary as that and that to assume the contract along with the other obligations of the Carnegie company might in all probability be impossible to the new corporation. He drew a paper from his pocket and said: 'Mr. Morgan, here is my contract. It calls, as you will see, for $1,000,000 a year for five years. It has been in force for two years, and in that time I have drawn $200,000 against my salary account. I am fully aware of the fact that sentiment and not business led Mr. Carnegie to draw that contract. I appreciate now that it offers an obstacle to this project, which is vastly favorable to the Carnegie interests and directly in line with the personal desire of Mr. Carnegie to be relieved of business responsibility. You need not hesitate on account of this contract. There is an easy way to settle that matter.'

"Thereupon," continued Mr. Morgan, "Mr. Schwab tore the contract to pieces before my eyes. I felt it my duty to detail to Mr. Carnegie the scene in my office when the contract was destroyed. He smiled and said that there were few men in the world like Schwab. 'I don't propose that he shall lose anything by what he has done,' said he. 'I shall send him my check for the amount he lost when he destroyed the contract.' Mr. Carnegie drew his check for $4,800,000 and sent it to Mr. Schwab with a note explaining his understanding of the transaction in my office. That, I believe, is the basis for the stories we hear of the enormous salary paid to Mr. Schwab by the new corporation. As a matter of fact this salary as president of the corporation is not larger than that of a good many railroad presidents."

SUMMARY OF NAVAL CONSTRUCTION.

The monthly summary of construction, issued by the navy department, shows that fair progress has been made during the month upon the protected cruisers and submarine boats. None of the battleships and armored cruisers recently authorized have as yet been laid down. Following is the summary:

		Degree of completion, Per cent.	
BATTLESHIPS.		May 1.	June 1.
Illinois	Newport News	92	94
Maine	Cramp & Sons	50	52
Missouri	Newport News	32	37
Ohio	Union Iron Works	42	53
Virginia	Newport News	0	0
Nebraska	Moran Bros. Co.	0	0
Georgia	Bath Iron Works	0	0
New Jersey	Fore River Co.	0	0
Rhode Island	Fore River Co.	0	0
ARMORED CRUISERS.			
Pennsylvania	Cramp & Sons	0	0
West Virginia	Newport News	0	0
California	Union Iron Works	0	0
Colorado	Cramp & Sons	0	0
Maryland	Newport News	0	0
South Dakota	Union Iron Works	0	0
SHEATHED PROTECTED CRUISERS.			
Denver	Neafie & Levy	45	47
Des Moines	Fore River Engine Co.	28	34
Chattanooga	Lewis Nixon	29	32
Galveston	Wm. R. Trigg Co.	22	27
Tacoma	Union Iron Works	18	20
Cleveland	Bath Iron Works	55	55
St. Louis	Neafie & Levy	0	0
Milwaukee	Union Iron Works	0	0
Charleston	Newport News	0	0
MONITORS.			
Arkansas	Newport News	54	57
Nevada	Bath Iron Works	86	87
Florida	Lewis Nixon	65	66
Wyoming	Union Iron Works	73	75
TORPEDO BOAT DESTROYERS.			
Bainbridge	Neafie & Levy	94	94
Barry	Neafie & Levy	88	88
Chauncey	Neafie & Levy	90	90
Dale	Wm. R. Trigg Co.	93	94
Decatur	Wm. R. Trigg Co.	95	96
Hopkins	Harlan & Hollingsworth	75	75
Hull	Harlan & Hollingsworth	74	74
Lawrence	Fore River Engine Co.	99	99
MacDonough	Fore River Engine Co.	98	98
Paul Jones	Union Iron Works	87	95
Perry	Union Iron Works	93	93
Preble	Union Iron Works	90	92
Stewart	Gas Engine & Power Co.	53	53
Truxton	Maryland Steel Co.	68	68
Whipple	Maryland Steel Co.	67	67
Worden	Maryland Steel Co.	67	67
TORPEDO BOATS.			
Stringham	Harlan & Hollingsworth	98	98
Goldsborough	Wolff & Zwicker	99	99
Bagley	Bath Iron Works	99	99
Barney	Bath Iron Works	99	99
Biddle	Bath Iron Works	98	99
Blakely	Geo. Lawley & Son	98	98
DeLong	Geo. Lawley & Son	98	98
Nicholson	Lewis Nixon	88	89
O'Brien	Lewis Nixon	90	92
Thornton	Wm. R. Trigg Co.	97	97
Tingey	Columbian Iron Works	68	68
Wilkes	Gas Engine & Power Co.	79	80
SUBMARINE TORPEDO BOATS.			
Plunger	Lewis Nixon	9	10
Adder	Lewis Nixon	50	60
Grampus	Union Iron Works	50	51
Moccasin	Lewis Nixon	40	58
Pike	Union Iron Works	50	50
Porpoise	Lewis Nixon	36	55
Shark	Lewis Nixon	35	53

THE IMMENSE DRY DOCK AT NEWPORT NEWS.

One of America's greatest dry docks, just completed at the works of the Newport News Ship Building & Dry Dock Co., Newport News, Va., is pictured in the engravings that appear in this issue. Both engravings indicate the great size of the dock. An idea of the length of the structure will be obtained from one of the pictures, showing that three steam vessels of fair dimensions do not begin to fill it. The new dock is known at the Newport News works as dock No. 2. It is a timber dock with masonry entrance. Dimensions are as follows:

Extreme length	860½ ft.
Length on bottom	804 ft.
Width on top	162 ft.
Width on bottom	80 ft.
Depth of water over sill at mean high water	30 ft.

The masonry entrance of the dock is constructed on a concrete foundation, which, in turn, rests on a pile and timber substructure. The pumping plant for the dock consists of two main centrifugal pumps of about 85,000 gallons capacity per minute each, and one drainage centrifugal pump of about 12,000 gallons capacity per minute. These pumps are driven by electric motors, the pump and motor shafts being vertical. The large motors are each of 1,000 H.P. at 500 volts. The small motor for the drainage pump is 350 H.P. at 250 volts. The electric current driving these motors is carried by underground cables from the main power house about 700 ft. distant.

Arrangements are now being made to pump out the old dry dock (No. 1) with the pumping plant just described. Dimensions of the old dock are as follows:

Extreme length	638 ft. 7 in.
Length on bottom	573 ft. 0 in.
Width on top	130 ft. 0 in.
Width on bottom	49 ft. 4 in.
Draught of water over sill at mean high water	24 ft. 6 in.

The immense steel caisson used as a gate to the large dock has already been described and illustrated in these columns.

THREE VESSELS IN IMMENSE TIMBER DRY DOCK OF NEWPORT NEWS SHIP BULDING & DRY DOCK CO.

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The board of construction of the navy department has recently been working out the details for the two battleships and two armored cruisers, plans for which are to be submitted to congress in December. Up to the present time the board has devoted itself to the consideration of the two battleships and has decided that they shall be of 15,000 tons displacement, with a speed of 19 knots. The advisability of having the battleships of greater displacement than 15,000 tons was carefully considered by the board, but the weight of evidence was against building vessels of larger displacement than this. It was also deemed advisable to limit the speed to 19 knots, as to require greater speed would be to reduce the coal capacity and consequently the steaming radius.

The Cornwall iron ore mines have become the property of the Pennsylvania Steel Co. The Cornwall mines consist of practically three hills of ore, ranging from 700 to 900 ft. high, known as Big Hill, Middle Hill and Grassy Hill. Since the discovery of the mines in 1740 upwards of 13,000,000 tons of ore have been won. The deposit runs about 48 per cent. in iron and is sufficiently low in phosphorus for Bessemer purposes.

Mr. Nicholas J. Quirk, marine artist of Chicago, has an excellent picture of the new battleship Maine in a New England number of the Youth's Companion and a picture of the Illinois in a recent issue of the Inter Ocean of Chicago. A reproduction of a drawing of the yacht Independence, made by Mr. Quirk, appears in this issue of the Review.

LARGEST VESSELS IN THE WORLD.

FIGURES SUBMITTED FOR THE GREAT NORTHERN LINERS SHOW THEM TO BE A TRIFLE IN EXCESS OF THE CELTIC'S MEASUREMENTS— EXTENDED DESCRIPTION OF THE NEW VESSELS.

It is a matter of nip and tuck between the Celtic of the White Star Line, built by Harland & Wolff of Belfast, and the two vessels now building for the oriental service of the Great Northern Railway at New London, Conn., as to which will be the bigger. There is little difference between them, but the figures submitted show that the Great Northern liners are a trifle the bigger. In the case of the Celtic the measurements are certain; with the New London boats the measurements are probably subject to slight revision, but whether they will alter the present condition is questionable. The Celtic is of the following dimensions: 700 ft. long, 75 ft. beam and 49 ft. deep; 20,880 gross tons and 13,650 net tons register; load displacement on 36 ft. 6 in. draught, 37,700 tons. The Great Northern liners are of the following dimensions: 630 ft. long, 73 ft. beam and 56 ft. deep; about 21,000 gross tons register; normal displacement as given out by the builders, 33,000 tons, and load displacement 38,000 tons. According to these figures the load displacement of the Great Northern vessels is 300 tons in excess of the Celtic.

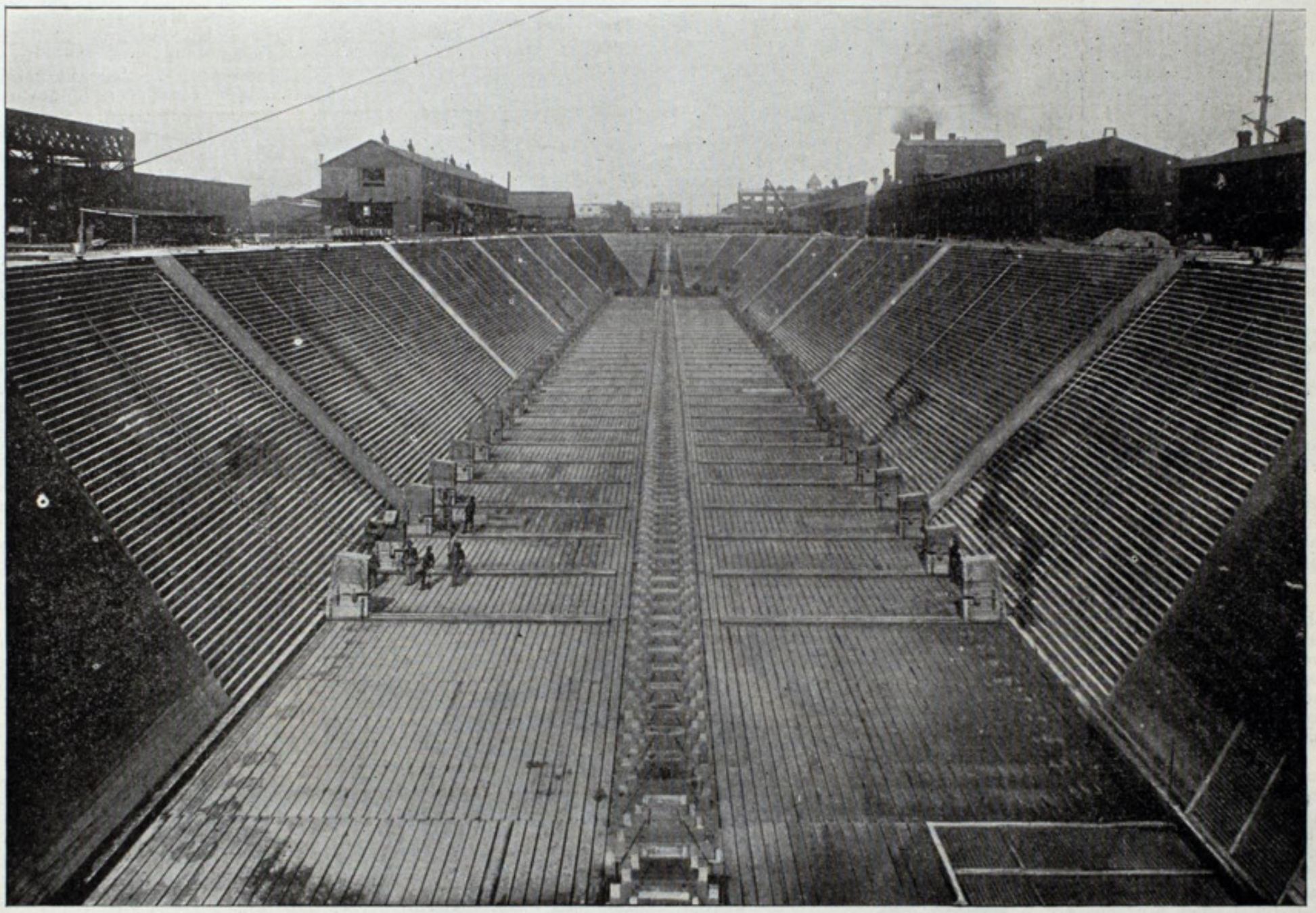
A description of the Great Northern ships is again printed in the columns on account of general interest in them, now that they are well under way, and for the reason also that the description at hand is more complete than anything as yet published. These steamships are being built primarily for cargo carriers. They are not as long as many of the fast Atlantic liners, but are much wider and deeper. They are four-masted steamships of the type called "intermediate," which has of late years become so popular on the Atlantic; that is to say, they are designed neither for rapid passenger service exclusively, nor for cargo carrying only, but for combined cargo and passenger traffic on the most approved, economical principles. One essential of this class of vessels is that there shall be sufficient speed to suit passengers, and at the same time a speed sufficiently low to warrant carrying a large bulk and weight of cargo economically.

They have each five continuous decks extending the whole length of the ship, with three additional partial decks amidships. They are built to Lloyd's highest classifications, and have been especially strengthened to meet the requirements of long sustained Pacific voyages. Internally they are divided into fifty water tight compartments, in such a way that the vessels will float with several of the largest compartments flooded. The enormous bunkers are arranged above the boilers, so that all the coal will gravitate to the fire rooms, and thus eliminate a great deal of hand trimming. To secure immersion of the screws when the vessels are running light, and to make the vessels comfortable in a sea way, deep ballast tanks are placed forward and aft in the space between decks. These tanks, along with the usual provision in the cellular double bottom, afford storage for about 6,000 tons of water ballast. The whole of the interior of the ship below the upper deck—except what is occupied by the machinery and bunkers—is arranged so that it can be set apart for cargo, and insulated chambers are provided for the conveyance of refrigerated goods. The holds are arranged so that any kind of cargo can be carried. Large machines, railroad iron, all kinds of building materials, produce from the farms, and all the different manufacturing products of the country. Fruit, chilled and frozen meats, live cattle, etc., have all been arranged for in the design of these ships.

For the working of the huge cargo eighteen large hatches are fitted with powerful winches and derricks, the majority of the latter being attached to each of the four massive masts. Cargo conveyors, electrically

operated, will also probably be fitted, and all modern approved methods will be employed that will reduce to a minimum the time taken in unloading and loading tremendous cargoes that these vessels will carry. The holds have a cubical capacity sufficient to stow 28,000 tons of coal. The dead weight carrying capacity at normal draught is stated at 20,000 tons. An unusually massive windlass will be placed underneath the upper deck forward, with two large warping capstans on each end of the ship. The steering gear will be of the electrical tiller type, and the winches for handling cargo will also be operated by electricity.

All the passenger accommodation on these ships will be located amidships. On the upper, promenade and boat decks are large, airy, comfortable state rooms, excellently arranged and furnished for the accommodation of 150 first-class passengers. Several private suites of rooms will be arranged, and the accommodation includes luxuriously appointed dining room, smoking room, drawing room and library; also children's nursery and play room. The second-class accommodation will be aft of the machinery on the main deck. Here large, comfortable state rooms are arranged for about 100 people. The second-class passengers will also have a large dining saloon, finished in quartered oak, and in the large deck house on the upper deck a well appointed ladies' room, smoking room, finished in hard wood, with conveniently arranged bar, bath rooms, etc.



VIEW OF NEWPORT NEWS DOCK JUST FOLLOWING ITS COMPLETION.

Copyrighted, 1901, by Samuel E. Rusk, Newport News, Va.

The third-class accommodation is arranged forward of the machinery space on the main deck, and here will be located well appointed state rooms for about 150 people, with large dining room in the center of the ship and all modern conveniences. Portable quarters, with removable berths, will be arranged for about 1,000 steerage passengers, and portable fittings will be arranged on the main deck aft for the carrying of about 350 head of cattle. The officers' quarters are grouped about the engine casings and will be well fitted and conveniently arranged, while the crew and petty officers will have their accommodation on two partial decks in the forward end of the vessel. There will be a large number of bath rooms on these ships, and special shower baths will be arranged for the firemen and sailors.

The ventilation will be quite a feature, and an unusually efficient and well arranged system will be installed. The drainage, plumbing and sanitary arrangements will be of the most approved modern type, and no expense will be spared to have these vessels rank among the most comfortable ships of the world from a passenger standpoint.

The propelling machinery for each ship consists of two sets of vertical, direct acting, triple expansion engines of the inverted marine type, each cylinder driving a separate crank. The high pressure cylinders are 29 in. diameter, intermediate 51 in., and low pressure 89 in. The stroke is 57 in. All cylinders are fitted with liners and steam jacketed. Each vessel will be fitted with two large propellers, each 20 ft. diameter, and at full speed these screws will revolve about ninety times per minute, driving the vessel, when loaded, at a speed of about 14 knots per hour. There are sixteen large Niclausse water tube boilers in each vessel, with a total grate surface of over 1,000 sq. ft., and with a heating surface of over 40,000 sq. ft. These boilers will be fitted with induced draft of a most economical kind. This arrangement will keep the fire room unusually cool and pleasant for the firemen, and at the same time the economy of the machinery installation will be much increased. Each vessel will be fitted with a complete evaporating plant, which will be capable of making about 80 tons of fresh water per day. Air heaters and feed water heaters are also to be fitted to increase the economy, and it is expected that these ships will rank among the most economical in the matter of coal consumption of any of their type at present afloat.

The total power of the machinery is stated at about 10,000 I.H.P. The electric plant will be unusually large. Five 75 K. W. machines will be fitted on each vessel. The power of the engines, driving the dynamo alone, will be about 700 H.P., and the power of the four engines driving the induced draft fans will be about 400 H.P., the total power of the ships' auxiliaries being about 1,800 H.P. A large electrically operated ice machine of the ammonia compression type will be fitted to keep the ship's provisions and refrigerated chambers during the long voyage of about three weeks' duration.

To build these ships 21,000 tons of steel is required and over 4,000,000 rivets. The average size of plate is about 25 ft. long and 6 ft. wide, weighing about 2½ tons. The frames of these ships are 30 in. apart and are 12 in. wide, being 30 per cent. larger than the largest frames ever used in ship construction up to this time. The floors of the vessel are 6 ft. deep, and a man can stand upright in the double bottom. The keels are 3¼ in. thick and there are certain parts of the upper works that are fully 3 in. thick. These vessels are of very strong natural proportions, and it is claimed that they will be the strongest and heaviest vessels ever built in the world. Large cargo ports are being cut through the sides in the upper works to facilitate loading and unloading of cargo. Coal ports are also placed in the side of the vessel, as well as the large hatches going through the decks above. It is expected that these vessels will be completed by the summer of 1902. Their cost will be about $2,500,000 each.

Both vessels are beginning to show indications of the large amount of work already done on them. The double bottoms of both boats have been built, the riveting having now been practically completed. This is the work that is slowest to make a show in steamship building; it takes longer and comprises more labor than any other part of a ship, not only in the shops, but on the vessel itself. A large section of the side framing has also been erected on both boats, and it will be now possible to notice definite progress towards completion from week to week.

The Cunard Steamship Co. is making initial experiments with the Marconi system of wireless telegraphy on the steamer Lucania, which has been fitted with the necessary appliances on her present voyage from Liverpool. The Marconi International Marine Communication Co., Ltd., is establishing stations for the receipt and dispatch of messages on the Welsh, Irish and American coasts.

Reduced rates to New York—Beginning July 1 the Nickel Plate road will sell excursion tickets to New York city at reduced rates with a liberal stop over privilege at Buffalo, thus giving ample time to visit the Pan-American exposition. Tickets may be procured good going and returning via different routes if desired. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, O. 105, July 15.

POWERFUL LIGHT FOR AN OLD TOWER.

INTERESTING STRUCTURE REPRODUCED AT THE GLASGOW INTERNATIONAL EXPOSITION—DESCRIPTION OF THE LIGHTING APPARATUS.

[Special correspondence to the Marine Review.]

Glasgow, Scotland, June 12.—One of the most striking features of the Glasgow International Exposition is a reproduction of the Bell rock light-house. The structure, of course, is only temporary, but the lantern, lamps and machinery are the actual plant for the actual light-house on the Bell rock on the east coast of Scotland, some 12 miles from Arbroath. It stands on a dangerous reef which is little more than awash at low water and is covered to a depth of 10 ft. at high water. This rock was first lighted in 1811, the tower taking four years to construct. The tower and apparatus were designed by Robert Stevenson, engineer to the commissioners of northern light-houses, and executed under his direct superintendence. It is now the oldest existing light-house tower in Great Britain, and shows no signs of the weakness which has appeared in other towers. Although the tower is still quite equal to its purpose, the lantern, and machine, which are about ninety years old, show signs of needing renewal, while both they and the apparatus are antiquated, and the light is too weak in power for such an important place. The commissioners of northern light-houses accordingly instructed Messrs. Steven & Struthers, Glasgow, to construct the lantern and machine now shown to the design of Messrs. D. & C. Stevenson, C. E., Edinburgh.

The optical apparatus has been specially designed to suit the peculiar circumstances. The light has to be maintained of its existing character, namely, a red and white flash alternately, and of a maximum power consistent with one of the beams being red. It is somewhat of the bivalve type, but differs largely from anything yet constructed. It is a combination of two orders—hyper-radiant and first order. The white flash consists of 40° of a hyper-radiant, the light from which is supplemented by back prisms of a size never before attempted. The red flash consists of 40° of hyper-radiant, the light being intensified by totally reflecting prisms subtending 145°. As the red glass shades abstract a portion of the rays by absorption, the red flash is further intensified by dioptric mirrors of the best type. The glass work has been made in Paris by Messrs. Lepaute et Cie, but is not of French design, as might naturally have been supposed. The flash will be about 112,000 candle power and is thus about five times the power of the most powerful red light of any French design.

The profiles of the prisms are designed for an index of refraction of 1.53 and the glass is set in a strong gun metal framing. The whole face of glass through which the parallel rays from the burner are sent present a surface of no less than 9 by 9 ft., or 81 sq. ft. of focal opening. The apparatus stands on a cast iron table, which is made to revolve on conical steel rollers with ball bearings, between steel rings, by a circular rack and pinion driven by a clock machine. Anti-friction roller bushes and ball bearing bushes are used in the construction of the different journals. The fly shaft makes 200 revolutions per minute and absolute regularity of the machine will be attained when fitted at the light-house by means of the governing fans. The burners are six-wick patent Doty burners and are supplied with paraffin oil forced up by a pump driven off the main gear of the revolving machine.

The apparatus is enclosed in a lantern 13 ft. 6 in. diameter, to be erected on the tower at the Bell rock after the existing lantern has been removed. The lantern is sixteen-sided. The sash frames and astragals, which are triangularly made and thus of the strongest form, are made of gun metal of such a proportion of parts as to attain a strength of 16 tons per sq. in., with an extension of at least 6 per cent. The frames are glazed with polished mirror plate glass. The dome is of sheet copper of a spherical shape, surmounted by a ventilator to secure a proper draught and exclude the severest storm. The lightning conductor is ¾ in. diameter and will be connected to the existing lightning rods of the Bell rock, for the tower was originally protected by a lightning rod inside as well as outside, so that all metallic bodies are in metallic connection.

The fog signalling arrangement at the Bell rock will be maintained as at present, being an explosive signal of tonite fired by an electrical battery designed so that the signal cannot be fired until the charge is raised to the top of the lantern.

Messrs. Steven & Struthers also exhibit in the tower of the temporary light-house specimens and photographs of the large bronze castings of which they make a specialty, including sterns, sternposts, propeller brackets, rudders, etc. Some of these castings weigh 20 tons. Specimens of their high tension "Marine" bronze, now largely adopted for propellers, are also on view, showing the high tensional and bending strains which this metal can resist. A breaking strain of up to 32 tons per sq. in., with an elongation of 30 per cent. on a length of 2 in., is regularly obtained from a bar 1 in. in diameter, and a bar of this diameter can be bent round a radius of 1 in.

From a drawing by Nicholas J. Quirk, Chicago.

THE LAWSON YACHT INDEPENDENCE.

NOVA SCOTIA AS A PIG IRON MAKER.

(From the London Statist.)

A notable event in the iron world, and of great interest otherwise, is the arrival in the Clyde this week of a cargo of 3,500 tons of pig iron from Canada. The quality corresponds with Cleveland iron, and is therefore suitable for foundry purposes. It comes across, we understand, at a freight of 10s. per ton, which is about the equivalent of half the bounty on export granted by the Dominion government; and it incurs landing and other charges amounting to 5s. per ton, which closely approximates the cost of taking Cleveland iron to Scotland by sea. This Canadian product then enters into direct competition with Cleveland iron, which, again, displaces Scotch ordinary iron—at a price. The price at which the Canadian iron has been sold has not yet been disclosed, but Cleveland warrants are just now 8s. 6d. per ton under Scotch G. M. B., which is considerably more than the normal difference, so that the moment of arrival is not very opportune from the Canadian point of view.

The shipment marks a strange reversal in the current of trade, for Canada has been in the habit of taking about 10,000 tons of pig iron per annum from us, notwithstanding the contiguity of the United States. But it marks more than that. This iron comes from Cape Breton, Nova Scotia, where have just been completed four large blast furnaces for the smelting of iron ore conveyed at a low rate of freight, and on a short sea run of twenty-four hours or so, from the iron mines of Newfoundland. These mines are near the seaboard and are cheaply worked, so that the ore is one of the cheapest ironstones in the world. It is conveyed to Sydney, Cape Breton, for a fraction of the cost of conveying ironstone from Lake Superior to Pittsburgh, or from Bilbao to Middlesbro' or Glasgow, and the furnaces in which it is smelted are right on a rich and cheaply worked coal field on the seaboard. Here are being erected a plant of some 400 coke ovens, and works for the manufacture of steel on a great scale. At Cape Breton the cost of the materials for the manufacture of a ton of iron is said to be only 3s. 3d. per ton, as against 13s. per ton at Pittsburgh. The peculiar advantages under which this new Nova Scotian enterprise is being started are well understood in the United States, and the knowing ones in the trade there have for some time been predicting that the cheapest iron and steel in the world will in the future be produced in Canada. As to this we know not, but it is very evident that the first cost of iron smelted on the seaboard, with coal requiring no transport, must be much lower than anything the United States can show under present conditions of working. Whether it will pay Nova Scotia better to export pig iron than to turn it into steel is another question. The one disadvantage under which Cape Breton must sufer is in the matter of freight, for we do not know what cargoes large steamers can get to induce them to go there for return cargoes of iron, and to go there in ballast must be, of course, to enhance the outward freights. In the meanwhile, however, it must pay the smelters handsomely to export pigs, because of the bounty, which bounty has been extended to 1907.

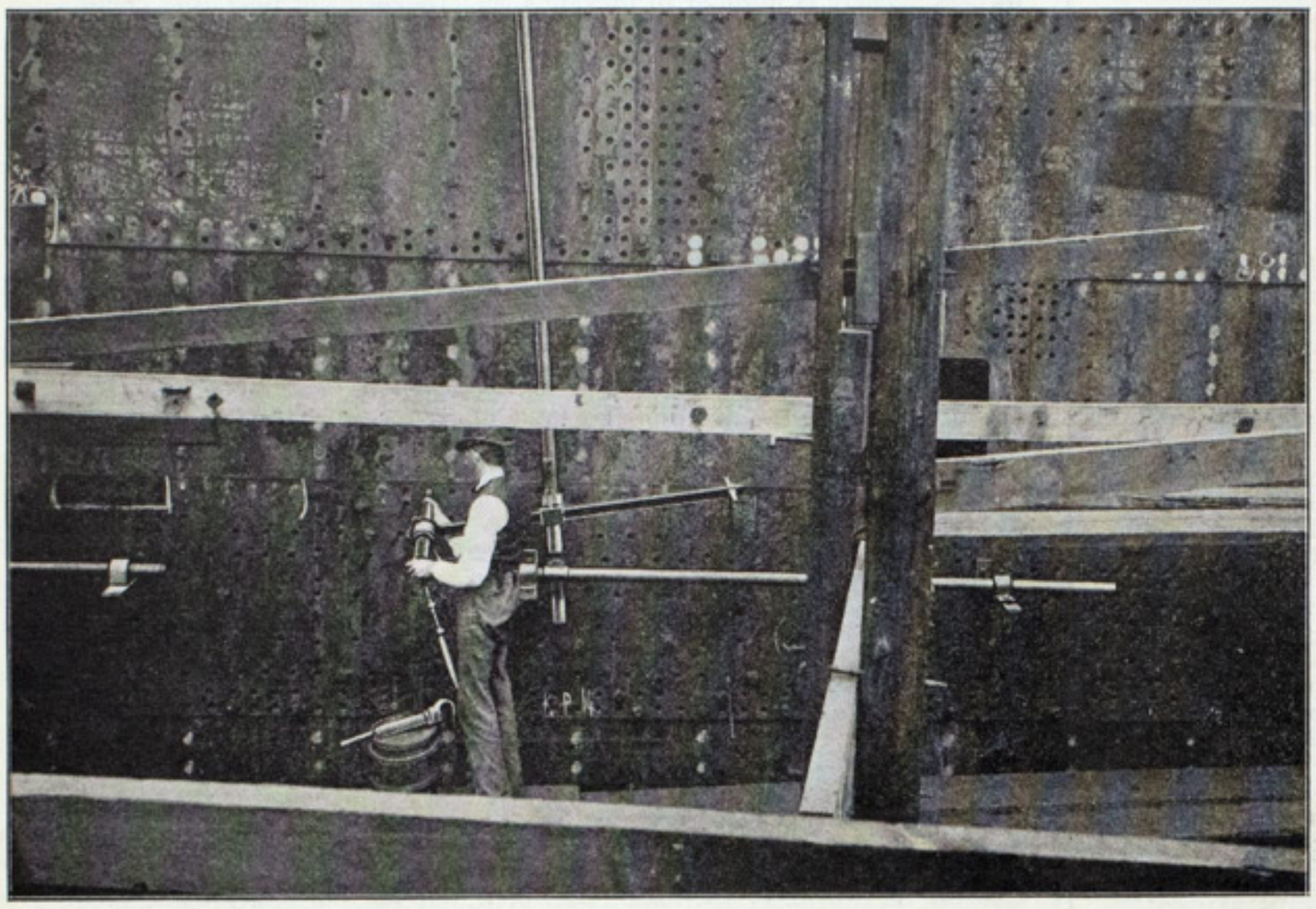
Sydney, C. B., in two years has increased its population nearly fourfold and is already called the Pittsburgh of Canada. It promises, also, to be the rival of our Middlesbro' and Birmingham. From a provincial village it has been converted into a busy manufacturing town. Iron smelting is not quite a new thing there, but nothing has before been attempted on the present scale—favored in every way by the municipality, sanctioned and supported by the state legislature, and endowed by the Dominion parliament. Up till now Canada has not made more than about 90,000 tons of pig iron per annum. The new plant is equal to about 200,000 tons per annum. This, of course, is a small thing compared with the United States, or with Cleveland, and is not very large even compared with Scotland. But it is only the beginning of an industry of immeasurable possibilities. This pioneer cargo sent to the Clyde may mark the beginning of a new epoch. The difficulties attending the supply of ore for our blast furnaces seem to become greater year by year. It is pleasanter to have to look to Canada for future supplies of crude iron than to the United States, even though the enterprise at Cape Breton is being developed at present by United States capital.

GREATLY IMPRESSED WITH PNEUMATIC TOOLS.

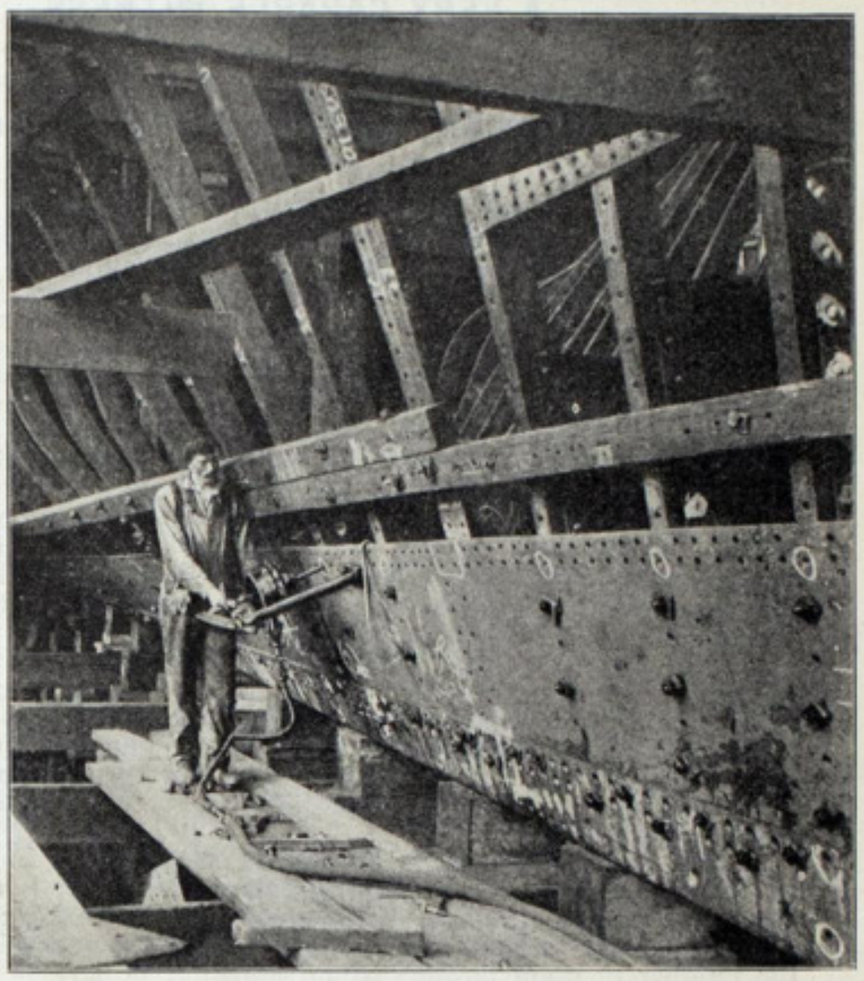
Chicago, Ill., June 18.—kecognizing the rapid advancement of ship building in America and as an acknowledgement of the necessity of bettering their own methods in this line of industry, the German government has sent two representatives to this country to investigate and report fully upon all that is new in our ship yards. These two eminent engineers are Tjard Schwarz, imperial high director of marine of his majesty's navy, and Professor E. Von Halle, engineering expert. The latter was in America during the World's Columbian Exposition at Chicago in 1893. He has been in this country on his present sojourn for several months gathering data for use upon the arrival of Herr Schwarz. Together these men have been making a tour of American ship yards, having already visited the works of the Cramps at Philadelphia, the New York company's new plant at Camden, N. J., the Newport News works, and last week they were at Chicago, Detroit and Cleveland. By the end of this week they will have visited New London, Conn., and Bath, Me. This will complete their plans regarding American yards with the exception of those on the Pacific coast. The limit set for their return, July 1, alone prevented their including these in their itinerary.

As the net result of their researches, they say that the principal advantage which their American brethren enjoy over them is in the varied and extensive use of pneumatic tools as applied to ship building. They also found that the methods of applying these tools were uniform in the leading yards. These tools have been used to a great extent in German yards but up to the present time they had failed to recognize the many ways in which they could be utilized to advantage. Herr Schwarz and Prof. Von Halle, however, now return to their native land enthusiastic on the subject and will recommend the enlargement of their pneumatic plants to proper proportions. Last week was given up almost exclusively to the investigation of tools made by the Chicago Pneumatic Tool Co. On Wednesday morning they arrived at Chicago with a letter of introduction to Mr. John W. Duntley, president of the Chicago Pneumatic Tool Co., and by him were turned over to Mr. Fred F. Bennett of that company who escorted them to the yards of the Chicago Ship Building Co. at South Chicago. The German Consul at Chicago, Dr. Wevers, accompanied the party. Though imperial in its personnel the trip was made in democratic fashion and the gentlemen tramped about the yards, through the various shops, on board and beneath ships in course of construction during the whole afternoon, in spite of extreme heat. Mr. Eli Gunnell, superintendent, showed the party every courtesy and explained with minute precision the various phases of the work, answered questions, demonstrated tools and in fact "kept open house," so to speak. As a consequence Herr Schwarz and Prof. Von Halle are awaiting an opportunity to reciprocate, so keenly did they appreciate the courtesies extended. Matters of comparative cost of drilling, reaming, riveting, chipping, caulking and other lines of work were fully investigated to the great advantage of the pneumatic tools.

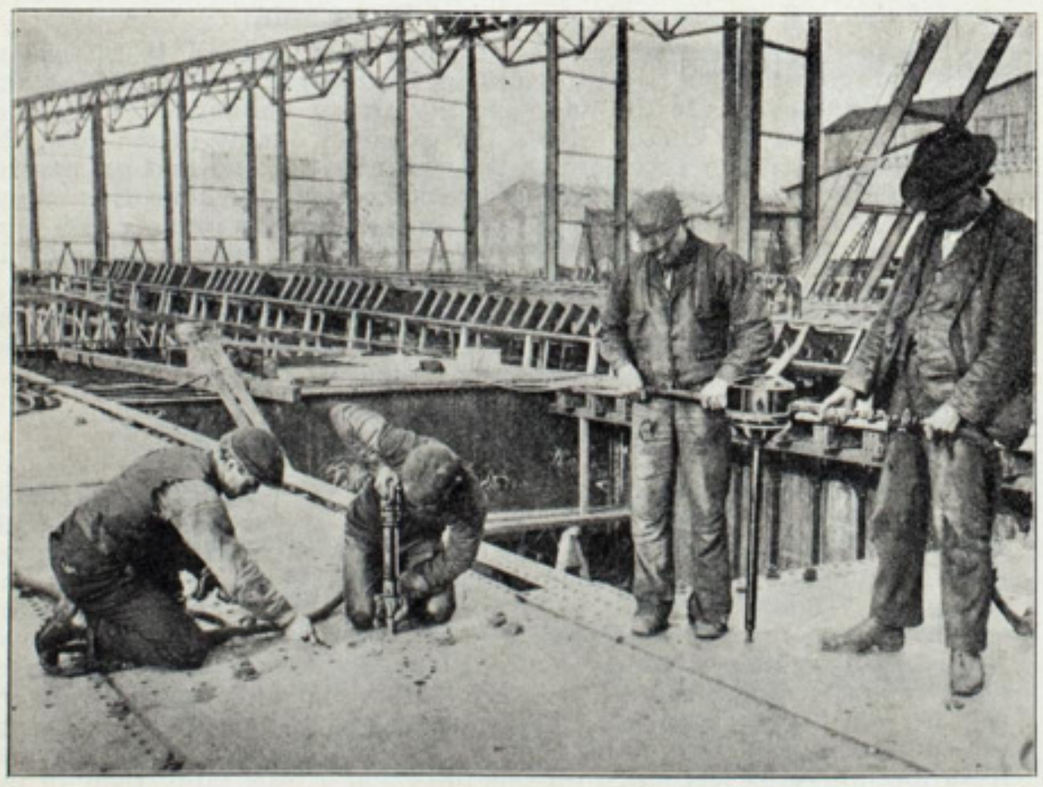
Perhaps the device which most impressed the German experts was the improved form of shell riveter. This machine, applied in various ways, has several times been illustrated in these columns, but some new views (not of this tool particularly, but several of the Chicago Pneumatic company's make) are presented on this page. The shell riveter is so arranged as to be bolted at the center by a single bolt to the deck, side or bottom of vessel and can be pushed, pulled or rotated to any point within 10 ft. of center without moving the anchor bolt. This machine was seen at work on deck, at the side of the ship and riveting from below. The varied uses of the long-stroke hammer also caused favorable comment as did also the work of the chipping hammer in removing surplus material. The efficiency and application of drills of the Duntley flat piston and Boyer types were also looked into. The most remarkable performance of these drills was thought to be the drilling of 3-in. holes in a solid stern post. However, its uses drilling on the side of ship, reaming on deck, drilling and reaming ship plates, were also looked upon as great advantages. In addition to these tools the side-light cutter, deck boring



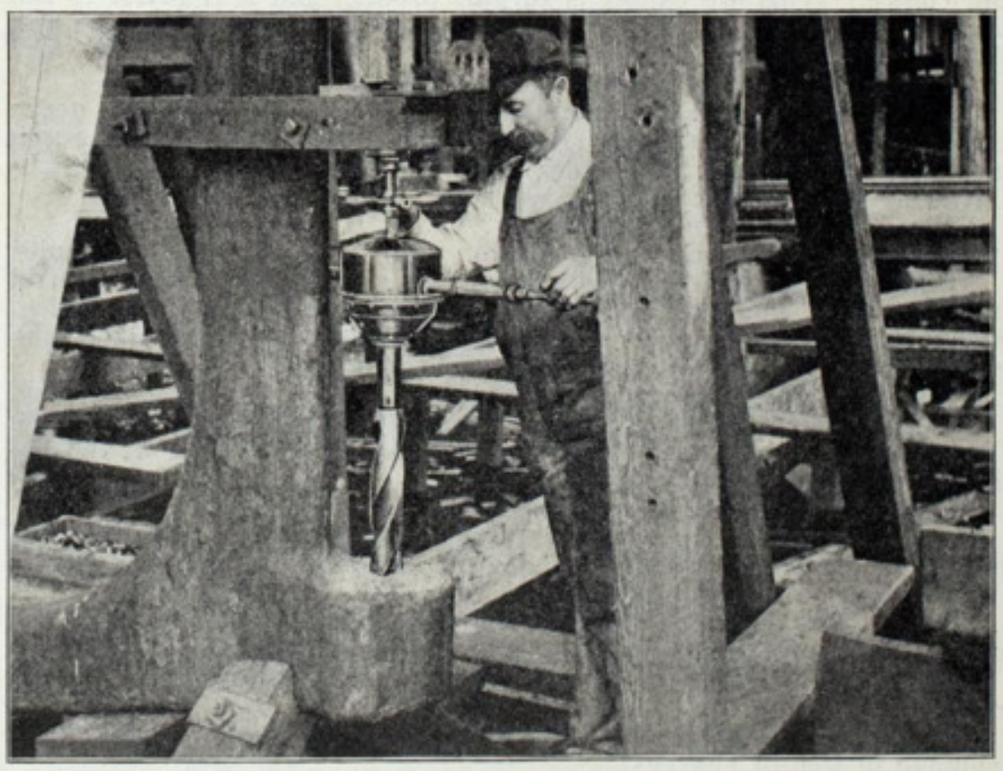
SHELL RIVETER AS APPLIED TO SIDE OF SHIP.



BOYER DRILL AT WORK ON HULL.



CAULKING, DRIVING RIVETS AND REAMING.



DRILLING 3-IN. HOLE IN STEEL STERN POST WITH BOYER DRILL.

machine and other applications of the Chicago company's devices were looked into and favorably commented upon.

On Thursday the party visited Detroit to inspect one of the factories where the tools of this company are made. Taking the boat from Detroit Thursday night they spent Friday in Cleveland at the Globe works of the American Ship Building Co., going from there to the Pan-American Exposition at Buffalo. They were expecting to sail about June 20 for Hamburg to make their report to the government. It might be noted incidentally that President Duntley of the Chicago Pneumatic Tool Co. sailed Saturday, June 15, on the Campania for a six weeks' trip among European representatives of that company.

A VERY CAPABLE WITNESS.

MR. WILLIS L. KING OF JONES & LAUGHLINS, LTD., DOES NOT LOOK WITH ALARM UPON THE UNITED STATES STEEL CORPORATION.

One of the clearest-minded men which the industrial commission has had before it in Washington is Willis L. King, vice chairman of Jones & Laughlins, Ltd., of Pittsburg. Mr. King does not look upon the United States Steel Corporation with distrust, but very frankly says that the great corporation will be a distinct benefit to the steel industry by bringing about a steadiness of prices such as has never been known. The tone of Mr. King's testimony was not in the least hostile toward the big rival of his partnership. On a few points his views differed from those of Mr. Schwab, but the difference was not radical. He agreed with Mr. Schwab that the Connellsville coking coal will be exhausted in thirty or thirty-five years, but he insisted that the coal on the Monongahela is just as good, and that it is notorious that Pocahontas coal is purer than either. He thought that the visible supply of iron ore in the Lake Superior region would last at least eighty or 100 years. That, however, he did not consider an important point. Like gas and oil, he believes more ore will be found in that region whenever it is needed.

On the subject of the elimination of competition by the organization of the steel corporation Mr. King made this significant declaration: "There is a very respectable minority of the steel industry that is not controlled by the corporation. I think it is big enough to prevent the exaction of unduly high prices. If the steel corporation cuts prices its losses will probably bear the same proportion to its capital stock as our losses would to ours."

"Will not opportunity to go into the steel making business be denied to small capitalists?" is a question answered by Mr. King in two ways. His first answer was that if farming and steelmaking were the only careers open for capitalists of small means in the future he had no doubt the number of good farmers would hereafter be largely increased. Another answer to this question was the statement of his opinion that it would cost between $20,000,000 and $30,000,000 to establish a plant so equipped as to enable it to make steel as cheap as the steel combine. But he added that capital was not the only thing to be considered; unless the proposed competitor had the means to supply itself with iron ore and coke it would be useless to construct a plant.

Mr. King was a fine witness from every point of view. His answers were direct and altogether clear. He had nothing he did not care to tell the commission. When asked about export business Mr. King said that the Jones & Laughlins partnership does not export much of its product. What it does send abroad is the higher finished part of its product, chiefly cold rolled shafting.

"How do your export prices compare with domestic?" Professor Jenks asked.

"They are somewhat lower," said Mr. King. "That, however, is not from choice. What we export is surplus product and it is better to sell it at no profit or a small loss rather than impair the efficiency of the mill by not running it full time."

"About how much of a concession do the foreigners get?"

"A dollar or two on the ton; that's chiefly on account of the ocean freight. We sell delivered at the foreign port. Freight charges for ocean carriage to the English market are from one and one-half to two times as great as from Pittsburg to the seaboard."

"This has all gone in foreign ships?" "Yes."

"Do you employ union or non-union labor?" asked Professor Jenks.

"I presume our mill is called a non-union plant. We have no quarrel with union ideas, but three or four years ago we thought we could deal to better advantage with our own men than through a union, so since then we have not dealt with the Amalgamated Association."

"Do you employ any union men?"

"I don't know. We never ask a man any questions on that score. When the change was made it was a question of wages, not of the so-called control of our works by the union."

"How have wages been since 1892?"

"They are higher than they were then. They were low during the panic years, but all the reductions made then have been restored, I think."

"Can you see any advantages in the recent combinations?"

"Yes, in the matter of sending from the plant nearest the consumer there is a saving in freight charges. The combination will be able to save in the cost of superintendence and in the consolidation of the clerical forces."

"Have you found any restriction in your business as the result of this advantage in freight charges?"

"We have not. Of course the combination is so new yet that we can't tell much about the effect it will have."

"Do you think you have any advantage over the steel corporation?"

"Yes, the fact that the corporation must depend on salaried managers and superintendents, while ours are part owners, is some advantage. There are some compensations in this life," he added with a smile.

Commissioner Litchman reverted to the question of wages. In answering him Mr. King said: "Generally speaking, I think our wages, on an average, are as high as, or higher than, the scale of the Amalgamated Association."

"You place so much stress on average. Why?"

"Because, in the past a few skilled men made big wages, while the many received very little. Now, owing to machinery and a change in methods, the average is increased."

Commissioner Kennedy asked if the existence of big corporations helps or injures smaller manufacturers.

"In order to compete a mill must be well equipped and control the raw materials it needs. A small mill, with a small tonnage, can not make steel at a price to compete because the charges for high skill and superintendence are about the same for a capacity of 200 tons or 2,500 tons a day."

"Then opportunities are restricted?" asked Mr. Phillips.

"For the individual, perhaps, but there is nothing to prevent the organization of corporations if there appears to be a need for more mills."

"Can mills be run as economically by salaried men as by owners?"

"I should say not; but the salaried managers might be made part owners. There is nothing to prevent that. Independent operators could not expect to live in competition with the United States Steel Corporation unless fortified with plenty of capital, good plants, and control of the raw materials they need. But there is a very respectable minority in the steel industry that will prevent unduly high prices. I think the chief effect of the organization of the big corporation will be a steadiness of prices, beneficial to all branches of the industry."

"Then you don't think competition has been crowded out," he asked.

"No. We do not feel alarmed at all."

Commissioner Farquhar wanted to know if Jones & Laughlins felt any greater competition when combination first became the practice in the steel industry. Mr. King said that sometimes the competition was very keen, but generally speaking conditions were not greatly changed after the combinations were made. Commissioner Clarke, who is from New England, wanted to know if the removal of the duty on ore and coal would enable the New Englanders to manufacture steel with the raw products of Nova Scotia, and thereby supply the railroads and machine shops of New England and Texas and the Pacific coast with steel rails and other heavy articles. Mr. King pointed out that Nova Scotia has no Bessemer ore and that the Nova Scotian coal has too much sulphur and phosphorous in it to be good for coking.

"As a general proposition, don't you think the tariff ought to be let alone?" asked Mr. Litchman.

"Yes, as a precautionary measure, I think it ought to be let alone."

"Do you think a tariff agitation at this time would be beneficial to the country?" was asked.

"Decidedly no," answered Mr. King, who was thereupon excused, as he had no suggestions to make.

THE WORLD'S COAL PRODUCTION.

The production of coal for the world's needs is becoming a political measure of importance and likely to occupy attention for some time. Discussion upon it was limited when Great Britain was able to supply the coal for the world, or the major part of it, but she no longer holds that supreme position. There is little truth in the stories of the impoverishment of the British supply, but the fact remains that it is costing more and more to get it to the surface. The high price opens the door to foreign invasion, and England is now getting some of its coal from France, Norway and the United States. Moreover, Great Britain is no longer the great coal producing nation of the world. She has lately been compelled to yield that office to the United States. Following are the figures: United Kingdom, 224,000,000 tons; United States, 230,250,000 tons; Germany, 135,800,000; France, 31,000,000; and other nations in lesser totals. Britain increased her output in 1900 by 18,000,000 tons, but the increase in the United States was 30,000,000 tons, or nearly the whole annual output of France. The great gain in the United States is due to labor saving machinery. The United States owes 23 per cent. of its output of coal to the use of coal cutting machinery, but only 1½ per cent. was so obtained in Great Britain. Arthur Peel, a British commissioner, in a recent report of the coal resources of the United States, said:

"West Virginia possesses an estimated coal area of 16,000 square miles, as against 12,000 square miles in Pennsylvania and 9,000 square miles in Kentucky. On the one hand the almost unlimited resources of the coal fields of the United States, the excellent quality of the coal, the possibilities of greater economy in the system of mining and greater reduction in the cost of freight, and, on the other hand, the immense amount of coal consumed in the United Kingdom, are considerations which tend possibly in the direction of trade of such a nature abroad as may result in a great development of the export of coal from the United States."

Mr. Peel foresees that the real competitor of Great Britain in the coal markets is the United States. The physical condition is such that the export coal trade of the United States is bound to grow.

GERMANY'S RANK AS A SEA POWER.

In any estimation of Germany's rank as a sea power the mercantile development of her ship building plants and of her over-sea carrying trade must be assigned a high value. In less than twenty years the progress made amounts to an economical and technical revolution in methods and resources. Today she is able to furnish all the vehicles of transportation and every type of warship demanded by her new ambition as a commercial rival or as an arbiter of war. As late as 1890 Germany was building three-fifths of her trading steamers in Great Britain and only ten years earlier was her most important ship building company in a position to attempt the construction of transatlantic liners. By 1898 the importation of ships from foreign yards had fallen off one-third and a little more than 16 per cent. of her own output was built for other trading nations. In January, 1900, she boldly challenged the ship yards of the world and entered a new epoch in the industry by launching, with much pomp and ceremony, the Deutschland, the fastest merchant vessel in the world. Such was the progress made in a single decade. Government encouragement has been a potent influence in the development, and this wise oversight may be said to date from 1870 when the duty on ship building material was removed and the corps of practical and theoretical marine architects and engineers created and fostered by the state began to exert its influence. Within her territory there now exist three imperial ship yards and thirty-nine important mercantile establishments for the construction of modern steamers. Five of these are equipped for the supply of battleships, nine others can build cruisers, five can turn out transatlantic liners of the highest type and at least fourteen can furnish passenger steamers of the first class.

AROUND THE GREAT LAKES.

The branch hydrographic office at Duluth, which is in charge of Mr. Frank Heinrich, nautical expert, has been removed from the Palladio building and is now in the former rooms at 1000-1002 Torrey building.

Lake barges that were taken to the Atlantic seaboard in large numbers two years ago to engage in the coal trade are now nearly all back to the lakes. Four vessels owned by J. C. Gilchrist of Cleveland, the Melvin S. Bacon, Thomas P. Sheldon, W. S. Crosthwaite and Verona have just left Boston for Lake Erie.

Capt. Geo. P. McKay, chairman of a special committee of the Lake Carriers' Association, appointed to look after the lighting of Pelee passage, Lake Erie, where a great number of vessels have been in trouble during more than a year past, hopes to have a light-vessel on Southeast shoal in that vicinity within a few days. The schooner Smith & Post has been chartered to act in the capacity of a light-vessel for the present season and is being fitted out as rapidly as possible.

Mr. Calvary Morris and other well-known Cleveland coal men who have for some time past been engaged in opening up extensive coal fields in eastern Ohio, are evidently planning to soon have in operation a new railroad to Lake Erie. The railroad company was organized several weeks ago, and now it is announced that H. A. Garfield, attorney representing these new interests, has purchased 175 acres of water front property on the west side of Fairport harbor.

A survey job for the U. S. S. Michigan is provided by a report of a shoal or obstruction of some kind in Lake Erie, made a few days ago by Capt. Robinson of the steamer Crescent City. Capt. Robinson says that while bound down Lake Erie, loaded, on June 11, when about five miles to the westward of Ashtabula and about four miles off shore, his vessel passed over an obstruction of some kind, possibly a shoal. The steamer did not strike, but "the pumps stopped and she labored hard." The captain adds: "There is quite a spot there of some kind."

With the rush of iron ore from the docks of Lake Superior that is now going on—the greatest ever known—some records are being made in the loading of big ships. In one day of last week (24 hours) 64,000 gross tons of ore was shipped from Duluth docks. This ore was loaded into fourteen vessels. The average cargo, it will be seen, was large, being 4,571 tons. The average ore cargo of ten or a dozen years ago for that number of boats, taken as they happened to come, would have not exceeded 1,500 tons.

Mr. Henry B. Wortley, chief designer for the Ocean Steamship Co. of Liverpool (better known as the Alfred Holt ship interests) is one of the naval architects of Europe who has been visiting ship yards of the United States recently. Mr. Wortley's general knowledge of shipping matters and the widespread reputation of the firm he represents were of great assistance to him in a flying trip through the ship yards of the Atlantic seaboard and great lakes. He visited all the principal yards in a stay of little more than three weeks and was very cordially received.

SOME RELIABLE PARTICULARS OF LARGE STEAMERS.

The main propelling engines of the White Star liner Celtic are of the quadruple expansion type balanced so as to minimize vibration. The cylinders work on four cranks, the arrangement of cylinders and valves from the forward end being as follows: High pressure with next its piston valve; then the second intermediate with its piston valve; a double-ported slide valve with a balance piston on the top for the low pressure, which comes next; then the first intermediate cylinder, with finally its piston valve. The cylinders are 33, 47½, 68½ and 98 in. diameter respectively, with a stroke of 63 in. Each cylinder is a separate casting supported in front on the A frame; while at the back there is a condenser incorporated into the framing of the low pressure and first intermediate cylinders. The air, bilge and sanitary pumps are worked by levers from the crossheads, but the centrifugal pumps are operated by separate engines. Weir feed pumps are used for the main and auxiliary feed to the boilers. The connecting rods are 141½ in. long between centers. The crank shaft is 19¼ in. diameter with 20 in. diameter crank pins. The line shaft is 18 in. diameter and the propeller shaft is 19½ in. The propellers are three-bladed and 20 ft. in diameter. The cooling surface of each condenser is 9,000 sq. ft. There are eight large Scotch boilers, 15 ft. 9 in. diameter and 19 ft. 6 in. long, with 1,014 sq. ft. of grate surface and 41,680 sq. ft. heating surface. The height of smokestack above grate bars is 120 ft.

There was launched from the Vulcan Works, Stettin, on March 30, a steamer built to the order of the North German Lloyd Co. for their Atlantic line. This new vessel, named the Kronprinz Wilhelm, is 665.04 ft. over all, 65.65 ft. beam, 42.68 ft. deep, of 15,000 gross tons register, 28.5 ft. load draught, 21,000 tons displacement and 22 knots sea speed. There will be accommodation for 600 first-class, 350 second-class and 700 third-class passengers, the crew numbering 525 all told. The propelling engines are quadruple expansion of the Schlick balanced type, the indicated horse power being 30,000 and the working pressure 213 lbs. There are twelve double-ended and four single-ended Scotch boilers, with 93,649 sq. ft. heating surface and 2,702 sq. ft. grate surface.

The Zeeland of the International Navigation Co.'s fleet, which recently arrived in New York on her maiden voyage, is 560 ft. long, 60 ft. beam, 42 ft. deep and of 12,000 tons register. She has quadruple expansion engines with cylinders of 31, 44, 62 and 88 in. diameter, and a stroke of 54 in. The working pressure is 200 lbs. The Zeeland maintained a speed of 17.3 knots for 12 hours on her speed trial in April last.

The Nickel Plate road offers low excursion rates to Denver, Colorado Springs, Glenwood Springs, Col.; Ogden and Salt Lake City, Utah; Hot Springs, S. D.; St. Paul and Duluth, Minn. Tickets on sale from June 18 to Sept. 10, good to return until Oct. 31. Write, wire, 'phone or call nearest agent, or E. A. Akers, G. P. & T. A., Cleveland, O. 95 Sept. 10.

THE GUARDIAN TRUST COMPANY,

108 SUPERIOR STREET, CLEVELAND, O.

OFFERS SUBJECT TO PRIOR SALE

$150,000

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—OF—

The Calumet Transportation Co.

secured by "Blanket" Mortgage upon the new Steel Steamers

G. A. FLAGG, RANDOLPH S. WARNER,

each 336 ft. length, 42 ft. beam and 26½ ft. depth,
and upon new Steel Schooners

A. W. THOMPSON, S. D. WARRINER,

each 300 ft. length, 42 ft. beam, 24 ft. depth.
Combined capacity of four vessels, 18,000 tons.

$633,000

First Mortgage 5% Gold Bonds

—OF—

THE GLOBE STEAMSHIP CO.

secured by "Blanket" Mortgage upon the new Steel Steamers

NEPTUNE, URANUS,
VENUS, MARS,
SATURN, JUPITER,

each 366 ft. length, 48 ft. beam, 28 ft. depth, and of 6,000 tons capacity.

These bonds are secured by mortgage or deed of trust to the Guardian Trust Co., as Trustee, in the one case upon two modern, new steel steamers and two new steel schooners, and in the other case upon six modern, new steel steamers, the insurance upon which, payable to and deposited with the trustee in the interest of the bondholders, exceeds in each case the total bond issue. The bonds mature in annual installments and as no part of the mortgaged property can be released until every bond is paid, the margin of security constantly increases.

As the bonds mature in yearly installments from 1902 to 1913, either long or short time securities can be furnished to suit purchaser.

Both bonds and semi-annual interest coupons are payable at office of The Guardian Trust Co., Trustee.

Prices to net the investor 4¾ %. Special descriptive circular upon application.

CLERGUE ENTERPRISES AT THE SAULT.

A SUMMARY OF DEVELOPMENT WITH WATER POWER PROJECTS AND IRON MINES—PLANNING FOR AN OUTPUT OF 400,000 TONS OF ORE.

Sault Ste. Marie, Ont., June 18.—More new Clergue works at this point, based upon the sulphur reduction processes discovered by the experiments of the company, are about to begin operation. These works include a sulphur reduction works, that will take the sulphur out of the pyrrhotite ores, owned by the company, and collect the fumes for use later in mechanical and chemical processes. They also include works for the manufacture of this sulphur into commercial products, such as sulphurous anhydride, sulphite liquor, sulphuric acid and the like, and a sulphite pulp mill. This is an immense structure, now done, and almost ready to operate. The company has a 100-ton mechanical pulp mill in operation, and has been selling a ground wood pulp made therein. It will hereafter make a mixed pulp, putting into the ground wood a percentage of sulphite pulp for the various requirements of the paper trade. Connection is now being made between the two mills, and the proper mixing machinery is being installed in the mechanical mill. Pulp containing any required percentage of sulphite will be delivered to paper mills. The company has no intention of going into the paper making trade at any time.

On account of the great withdrawal of water from Lake Superior upon the completion of the canal on the Michigan side of the rapids, which is now 90 per cent. completed, there might, probably would be, a gradual lowering of the water level in the great lake, that in time would have a serious effect upon navigation and kindred interests. In order to avert such a catastrophe the company, with the expectation of approval of the war department, is now giving to contractors plans for a steel and concrete dam to cross the river at the head of the rapids. It will be commenced the coming winter and pushed to completion. It will be about half a mile long, with heavy concrete piers at frequent intervals, connected by steel gates and shutters. As the power canals of the company increase and take more and more of the water flowing out of Lake Superior, the dam will be closed tighter and tighter, and finally it is intended that the present rapids will be bare.

By recent government concessions and grants this company has secured additional immense acreage of land, both timber, farming and mineral. The newest grant is that for the Manitoulin & North Shore line. There are now grants of land for the various sub-companies of the Algoma company that amount to about 5,500,000 acres. Vast tracts of this is woodland, and of this much is the finest spruce and hardwood. The spruce will be used for paper and lumber and the hardwoods will be cut for charcoal making. The company has therefore grants of land that insure material for its industries for a long term of years.

Contracts have just been made for the erection of two large blast furnaces, to be capable of operating with either wood or coke fuel, and these are intended to use charcoal, to be made from woods of the grants. Tests are now under way of new processes for the carbonizing of wood so as to save as much of the byproducts as possible and still leave a fuel of great efficiency. These tests have shown a charcoal hard as coke, porous and of high grade. Byproduct ovens to make sufficient fuel for the entire blast furnace plant will cost several million dollars. These furnaces are designed to feed a steel works now under way and which are expected to begin making rails in the coming autumn. An open hearth plant will be erected as soon as the rail mill is completed.

These steel mills, and other plans for additional works that are not yet announced, will require considerable ore. They will need a mixture of ores to produce a good metal. The Helen mine is a very large property. It is likened by the Ontario bureau of mines to the vast deposits of Michigan and Minnesota, and is probably the only deposit so far developed in Canada that can bear such distinction. It has a cube, as shown by drillings and explorations, of 200 by 400 by 1,000 ft. If this is all ore it is a very large deposit. It is not a Bessemer ore at present, though the deeper borings show Bessemer at lower levels, and it does not run so high in iron as the Lake Superior shipments have averaged in past years. Its advantage is that the rail haul is but 12 miles, all down hill, over a road owned by the mining company; that the lake haul is short; that the ore is exceptionally good for furnace work, and that it is of as high grade as many ores that are now being shipped and that will be accepted as excellent in the future. This mine lies upon a wall of banded magnetite and jasper, under a capping of siderite, both magnetite and siderite running well in iron. It is a surface deposit, is easily mined, easily crushed and quickly shipped.

The Josephine mine was discovered by diamond drill explorations in a valley some 11 miles distant from the Helen, the drillings having been determined upon after an examination of the float mineral by Mr. E. V. Clergue, manager of the mineralogical department of the business. It is apparently a large deposit of Bessemer ore of good grade. It will be opened at once and will ship some little ore this year perhaps. A railroad has been graded to the mine, leaving the Helen line below Lake Talbott and running along at a lower elevation across that lake. This line is railed and bridged for a part of its length and will be completed as soon as the rails can be brought in.

At the Helen they are installing a second crusher and will operate the two as well as a steam shovel for the rest of the season. They expect to ship about 400,000 tons this year, and have shipped about 30,000 tons to date. The ore dock at Michipicoten is a unique affair. It has but one track and no pockets. It is of the length of about one steamer. It will be enlarged this year, not by an extension to the dock proper, but by storage tracks in the hill at its base. A number of twelve-car spur tracks will be put in, each capable of holding 600 tons in ore cars. The cars will be brought down from the mine and stored in these spurs instead of ore being stored in dock pockets. When wanted the short trains will be shunted to the dock and unloaded, the place of one string of cars being quickly taken by another. It is believed that the short haul from the mines, the few

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grades of ore to be shipped, and the economy of the small single-pocket dock will permit this method and make a saving over usual practice. There has been a wonderful transformation in the mine road. A year ago it was almost a dangerous line, but no serious accident ever occurred thereon, though 140-ton locomotives and 50-ton cars were used from the very first. Now all the great trestles have been filled solid, the side-hill cuts widened and made secure, the timber bridges replaced by steel girder structures of the heaviest character, concrete and masonry culverts put in wherever needed, and the whole line relaid with 85-lb. rails. It is a remarkably solid and well built road for its age. A steam shovel has been at work on the line all the year and, with another, will soon be put in the mined ore at the Helen to assist shipments. D. E. W.

CURVE OF STABILITY.

Editor Marine Review: I note with pleasure the letter from Mr. Theodore Lucas in the Marine Review of June 13 in reference to my article on the "Curve of Stability," and in reply would submit the following demonstration, which will, I trust, give adequate justification to this element of the problem:

The use of the G M at 57.3° to determine the slope at 0° of a curve of stability for any ship may be demonstrated as follows: In Fig. 1 let B′ and B″ represent two consecutive positions of the center of buoyancy for the angles of inclination Q and (Q+dQ) respectively. Let B′M and B″M be verticals through these centers and G Z′ and G Z″ be perpendiculars to the verticals from G. Then, if the righting arm G Z be represented by k,—

G Z″—G Z′=Z Z″=d k; also
Z M×d Q=Z Z″; Therefore
Z M×d Q=d k.
Z M=d k/d Q..... A.

On a curve of stability, Fig. 2, draw a tangent at any point P; then if k represents the vertical ordinate (the righting arm)—

d k/d Q=tan. O P Q .....B.

Combine equations A and B, then

Tan. O P Q=Z M. ..... C.

Now if P Q be set off so that it represents on the horizontal scale of the curve diagram an angle whose circular measure is one, that is 57.3°, tan. O P Q may be written—

Tan. O P Q=O Q/P Q=O Q/1=O Q.....D.

From C and D it is seen that when P Q represents 57.3°, Z M=O Q, as both are equal to tan. O P Q. This equality is perfectly general in that it holds for any point on the curve and it will therefore hold at the 0° point; that is when the ship is upright. But when the ship is upright Z M becomes G M, therefore the erection of G M on a perpendicular at 57.3° will give the point through which a tangent to the curve at 0° must pass and thereby determines the slope of the curve at its initial point.

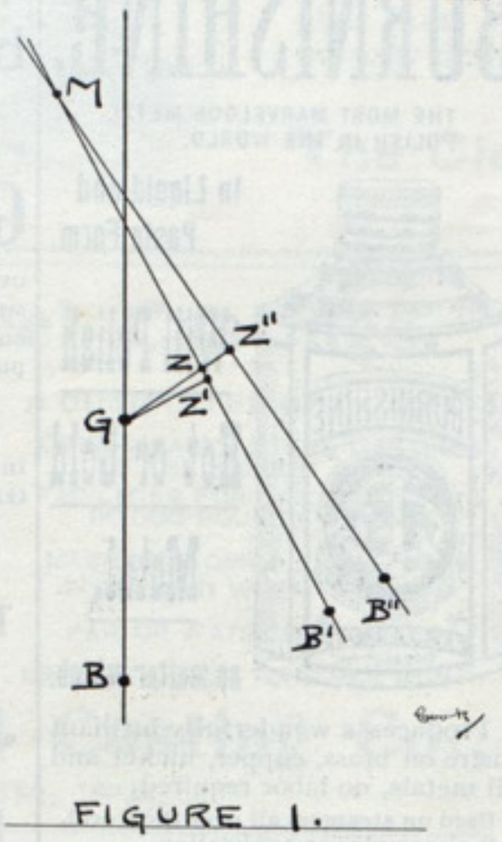

FIGURE 1.

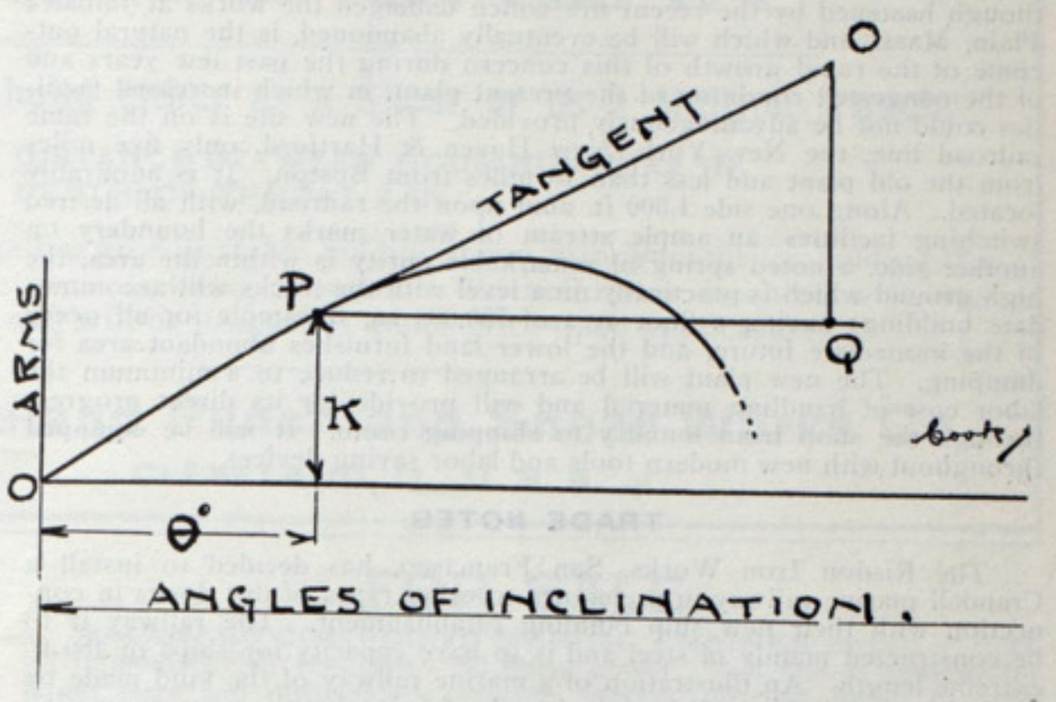

FIGURE 2.

Without actual time data it is difficult to judge the merit of the substitution of a second intermediate point for the slope at 90°. In most cases, however, this second point would come at such an angle as to require additional calculation for the placing of the water line, and even then, the arm as found by the direct method is not wholly accurate; while the slope as found is absolute and requires only the application of the conventional B M calculation.

GEORGE CROUSE COOK, A. M. I. N. A.
Fort Plain, N. Y., June 17, 1901.

BELLEVILLE GENERATORS

Grand Prix 1889 Hors Concours 1900
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Number of Nautical Miles made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australien	Polynésien	Armand Béhic	Ville de la Ciotat	Ernest Simons	Chili	Cordillère	Laos	Indus	Tonkin	Annam	Atlantique
1890.....	67,728	2,460										
1891.....	68,247	68,331	204									
1892.....	68,247	68,403	69,822	23,259								
1893.....	68,379	68,343	68,286	68,247								
1894.....	68,439	68,367	68,574	68,439	37,701							
1895.....	68,673	68,766	68,739	68,808	40,887	28,713						
1896.....	69,534	92,718	69,696	69,549	62,205	63,153	40,716					
1897.....	68,250	69,606	92,736	69,555	62,235	76,110	63,357	43,146				
1898.....	70,938	69,534	69,552	69,597	62,526	63,240	63,240	62,553	63,954	22,707		
1899.....	69,534	69,615	67,431	90,405	60,246	62,778	62,868	52,344	54,855	44,007	22,884	
1900...	69,534	67,494	69,744	69,564	61,719	62,382	62,502	51,471	53,373	62,016	63,066	52,140
Total.....	757,503	713,637	644,784	597,423	387,519	356,376	292,683	209,514	172,182	128,730	85,950	52,140

ATELIERS ET CHANTIERS DE L'ERMITAGE, À ST. DENIS (SEINE), FRANCE.
WORKS AND YARDS OF L'ERMITAGE AT ST. DENIS (SEINE), FRANCE.
TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT-DENIS-SUR-SEINE.

B. F. STURTEVANT CO.'S NEW PLANT.

After a most careful consideration of sites the B. F. Sturtevant Co. has recently completed the purchase at Hyde Park, Mass., of a tract of land containing some fifteen or more acres and is preparing plans for the erection thereon of a large up-to-date plant for the manufacture of blowers, engines, motors, forges, heating apparatus, etc. This purchase, although hastened by the recent fire which damaged the works at Jamaica Plain, Mass., and which will be eventually abandoned, is the natural outcome of the rapid growth of this concern during the past few years and of the congested condition of the present plant, in which increased facilities could not be advantageously provided. The new site is on the same railroad line, the New York, New Haven & Hartford, only five miles from the old plant and less than 10 miles from Boston. It is admirably located. Along one side 1,300 ft. abut upon the railroad, with all desired switching facilities, an ample stream of water marks the boundary on another side, a noted spring of remarkable purity is within the area, the high ground which is practically on a level with the tracks will accommodate buildings having a floor area of 750,000 sq. ft., ample for all needs of the immediate future, and the lower land furnishes abundant area for dumping. The new plant will be arranged to reduce to a minimum the labor cost of handling material and will provide for its direct progress through the shop from foundry to shipping room. It will be equipped throughout with new modern tools and labor saving devices.

TRADE NOTES.

The Risdon Iron Works, San Francisco, has decided to install a Crandall marine railway in preference to other types of dry docks in connection with their new ship building establishment. The railway is to be constructed mainly of steel and is to have capacity for ships of 480 ft. extreme length. An illustration of a marine railway of the kind made by H. I. Crandall & Son will be found in the firm's advertisement on page 7.

Lein, Irvine & Co., 328 East Twenty-third street, New York, have received a second order from the Patton line for "Perfection" berths, which are being installed throughout the new vessel they are building. The steamer Viking for Trinidad is fitted completely with these berths. They have also just finished a fine lot of berths with ash fronts for John Robbins Co.

The Brown Hoisting & Conveying Machine Co., Cleveland, has been awarded a contract for two complete coal handling plants, which will be installed at Wakamatsu harbor on the Klu Shu railway, Japan. These plants will each be capable of handling a 10-ton load, which is equal to a combined daily capacity of 5,000 tons. It is understood that this marks the first serious introduction of coal handling machinery into Japan.

It is again reported that capital has been secured for the establishment of a line of very fast steamers on the Hudson river to compete with suburban railway service between New York and such towns as Nyack, Tarrytown, Yonkers, etc. The vessels, to cost about $100,000 each, are to be designed, if the scheme goes through, by Charles D. Mosher, of fast river steamer fame, who is to attempt the production of a boat of nearly 40 miles speed, capable of carrying 250 passengers. The design contemplates a length of 130 ft., an extreme beam above the guards of only 15½ ft. and a draught of only 4½ ft. These dimensions are to be combined with 4,000 H.P. engines.

The 1901 catalogue of Marine Iron Works, station A, Chicago, is sent free on their receiving request. It is descriptive of their product, so far as the special line of work in which they are engaged can be catalogued. 2

BURNISHINE.

THE MOST MARVELOUS METAL POLISH IN THE WORLD.

In Liquid and Paste Form.

Will Polish Hot or Cold Metal, no matter which.

Produces a wonderfully brilliant lustre on brass, copper, nickel and all metals, no labor required.

Used on steamers all over the world. Free samples on application.

J. C. PAUL & CO.
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Worth is Proven by Use.

Words have not demonstrated the superiority of

Garlock Packings

over other makes. It has been done by their successful use on hundreds of thousands of engines and pumps, and for every known purpose on land and sea. This is the

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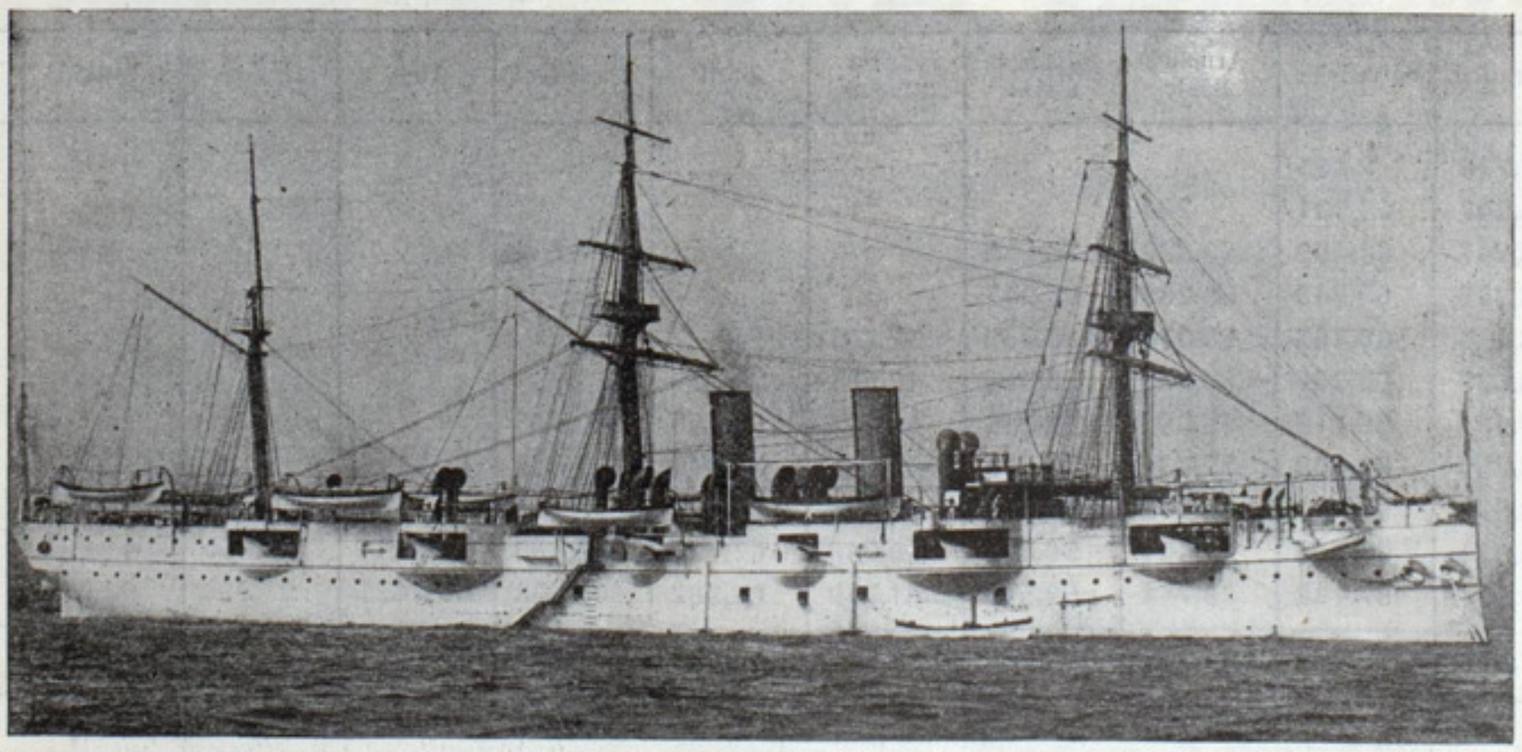

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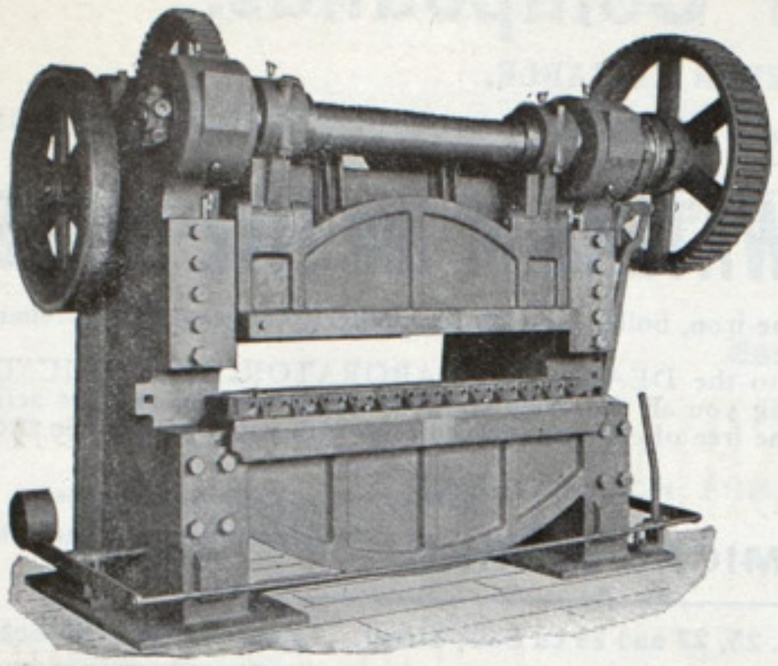

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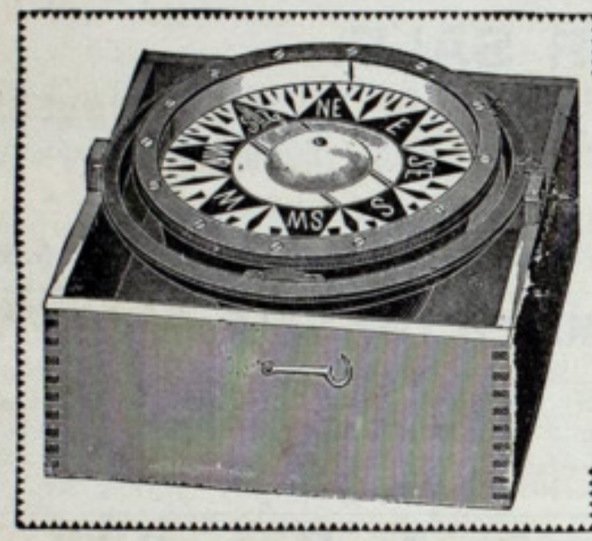

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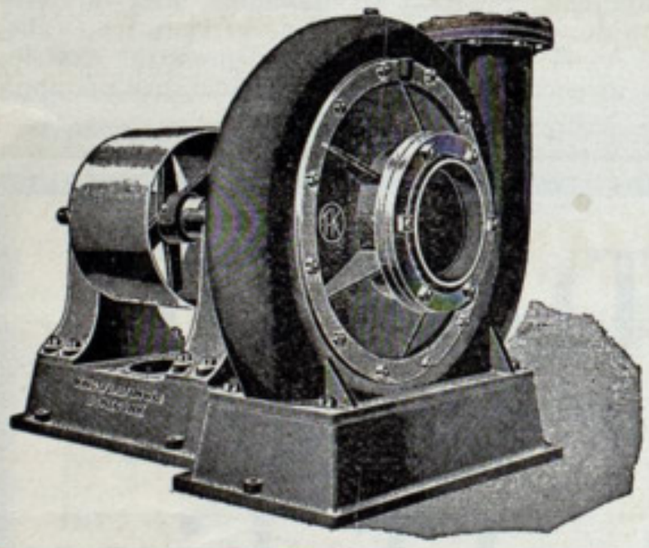

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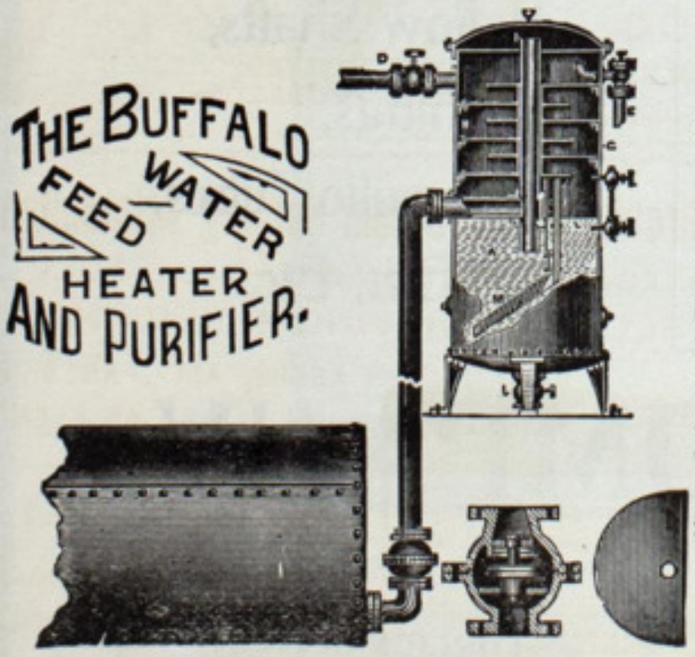

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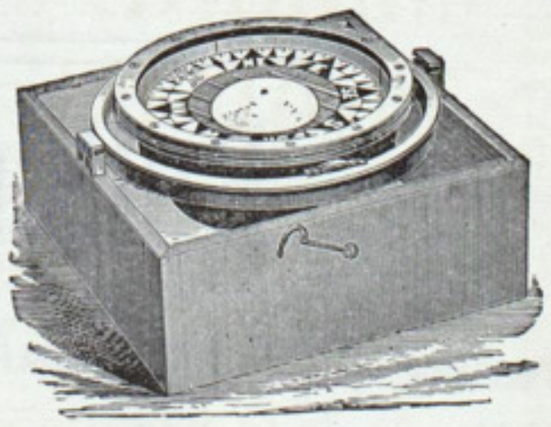

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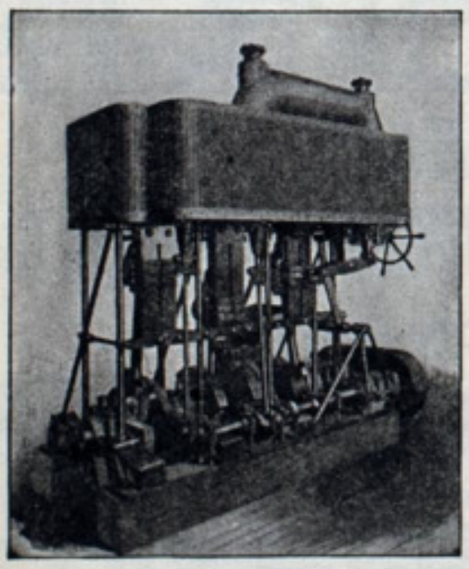

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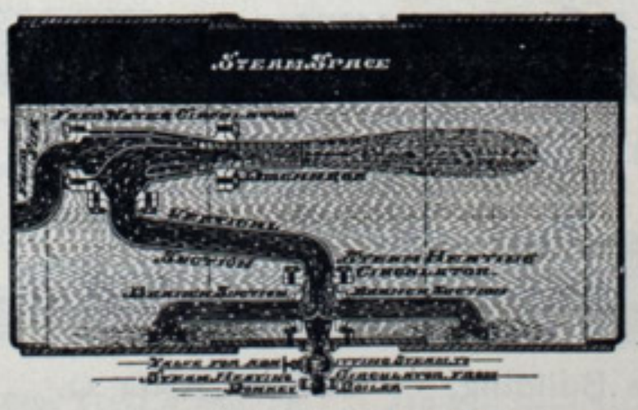

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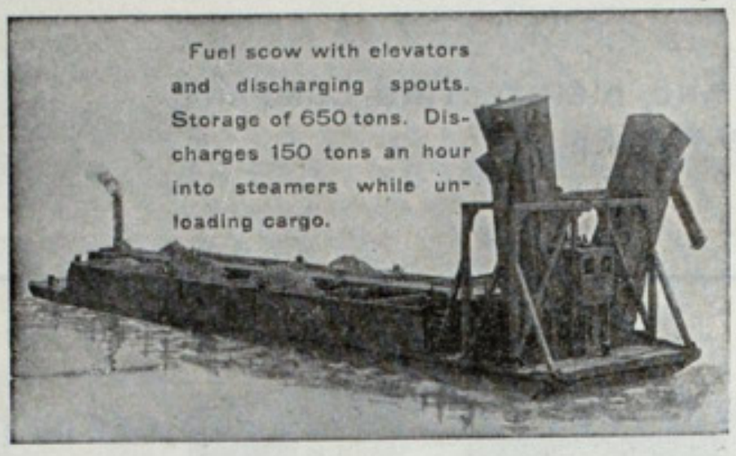

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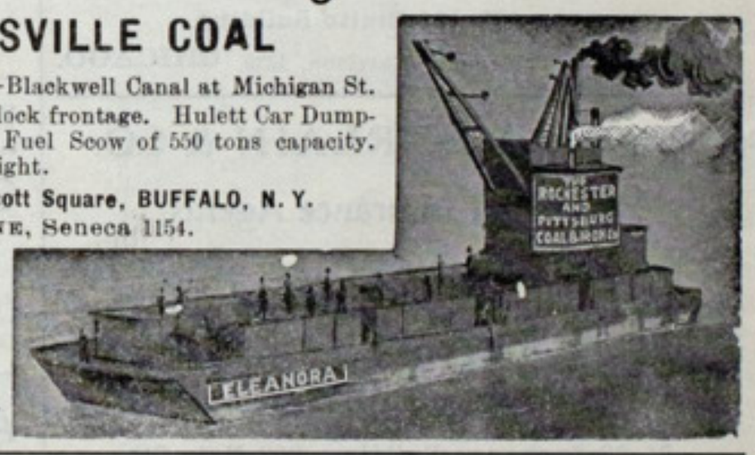

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American Ship Building Co.....Cleveland.
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Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lake Shore Engine Works.....Marquette, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Olds Motor Works.....Detroit.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.
Seidler-Miner Electric Co.....Detroit.

ENGINEERING SPECIALTIES AND SUPPLIES.

Crane & Co.....Chicago.
Reilly Repair & Supply Co., James.....New York.

ENGINEERS, MARINE AND MECHANICAL.

Electro-Dynamic Co.....Philadelphia.
Gaskin, Edward.....Buffalo.
Hunt, Robt. W. & Co.....Chicago.
Miller, Walter.....Cleveland.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
See, Horace.....New York.
Wood, W. J.....Chicago.

EVAPORATING AND DISTILLING APPARATUS.

Reilly Repair & Supply Co., James.....New York.

FANS FOR VENTILATION, EXHAUST, ETC.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Reilly Repair & Supply Co., James.....New York.
Reynolds, H. J.....Cleveland.

FIRE EXTINGUISHING APPARATUS.

Clayton Fire Extinguishing & Disinfecting Co.New York.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

FOG SIGNALS.

Colt Co., J. B.....New York.
Hamilton-Foster Fog Signal Co.....New York.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS.

Bourne-Fuller Co.....Cleveland.
Cleveland City Forge & Iron Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas).....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Ohio Fuel Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Scott Co., The W. L.....Erie, Pa.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.
Lake Shore Engine Works.....Marquette, Mich.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

GRAPHITE BUSHINGS AND BEARINGS.
Graphite Lubricating Co.....Bound Brook, N. J.

HAMMERS, PNEUMATIC.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, STEAM.
Bement, Miles & Co.....Philadelphia.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HATCH GEARS.
"Long Arm" System Co.....Cleveland.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co., Incorporated..Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

HOSE FOR PNEUMATIC TOOLS.
Sayen & Schultz.....Philadelphia.

HYDRAULIC MACHINERY.
Bement, Miles & Co.....Philadelphia.
Watson-Stillman Co., The.....New York.
Wood & Co., R. D.....Philadelphia.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

IGNITERS FOR GAS ENGINES.
Holtzer-Cabot Electric Co.....Brookline, Mass.

INJECTORS.
Crane Co.....Chicago.
Jenkins Bros.....New York.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

LAUNCHES—NAPHTHA, ELECTRIC.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

LOGS.
Walker & Son, Thomas.....Birmingham, Eng.
Also Ship Chandlers.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MACHINE TOOLS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

MALLETS FOR CAULKERS, BOILER MAKERS, ETC.
N. Y. Mallet & Handle Works.....New York.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Boston Blower Co.....Hyde Park, Mass.
Bloomsburg & Co., H.....Newport News, Va.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.
Paul & Co., J. C.....Chicago.

MILLING MACHINES OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Gaskin, Edward.....Buffalo.
See, Horace.....New York.
Wood, W. J.....Chicago.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Crane Co.....Chicago.
Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Sayen & Schultz.....Philadelphia.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PIPE THREADING AND CUTTING MACHINES.
Merrell Mnfg. Co.....Toledo, O.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.
Crane Co.....Chicago.

PLANERS OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PLATE BENDING AND PLANING MACHINES.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

PLUMBING, MARINE.
Mott Iron Works, J. L.....New York.
Reilly Repair & Supply Co., James.....New York.
Sands, Alfred B. & Son.....New York.

PNEUMATIC TOOLS.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.
Paul & Co., J. C.....Chicago.

PRESSURE REGULATORS.
D'Este Co., Julian.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Bullock Electric Mnfg. Co.....Cincinnati.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Kingsford Foundry & Machine Works.....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER GOODS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SEAM COMPOSITION AND ELASTIC SEAM PAINT.
Cole & Kuhls.....Brooklyn.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Trigg, Wm. R. Co.....Richmond, Va.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Moran Bros. Co.....Seattle, Wash.
Reilly Repair & Supply Co., James.....New York.
Upson-Walton Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Cleveland & Buffalo Transit Co.....Cleveland.
Dominion Line .....Boston.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL CASTINGS.
Seaboard Steel Casting Co.....Chester, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SUBMARINE DIVING APPARATUS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

SURVEYORS, MARINE.
Gaskin, Edward .....Buffalo.
See, Horace.....New York.
Wood, W. J.....Chicago.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.
Standard Pneumatic Tool Co.....Chicago.
Watson-Stillman Co.....New York.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Atlantic Works, Inc.....Philadelphia.

TOPOPHONE—Prevents disasters in fogs.
Colt Co. J. B.....New York.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

TRAPS, STEAM.
D'Este Co., Julian.....Boston.
Haines Co., Wm. S.....Philadelphia.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.
Benedict & Burnham Mnfg. Co.....Waterbury, Conn.
Standard Seamless Tube Co.....Pittsburg.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crane Co.....Chicago.
Crosby Steam Gage & Valve Co.....Boston.
D'Este Co., Julian.....Boston.
Jenkins Bros.....New York.
Wood & Co., R. D.....Philadelphia.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Hall & Root.....Buffalo.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Kennedy Hunter & Co.....Antwerp.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

VENTILATING APPARATUS FOR SHIPS.
American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

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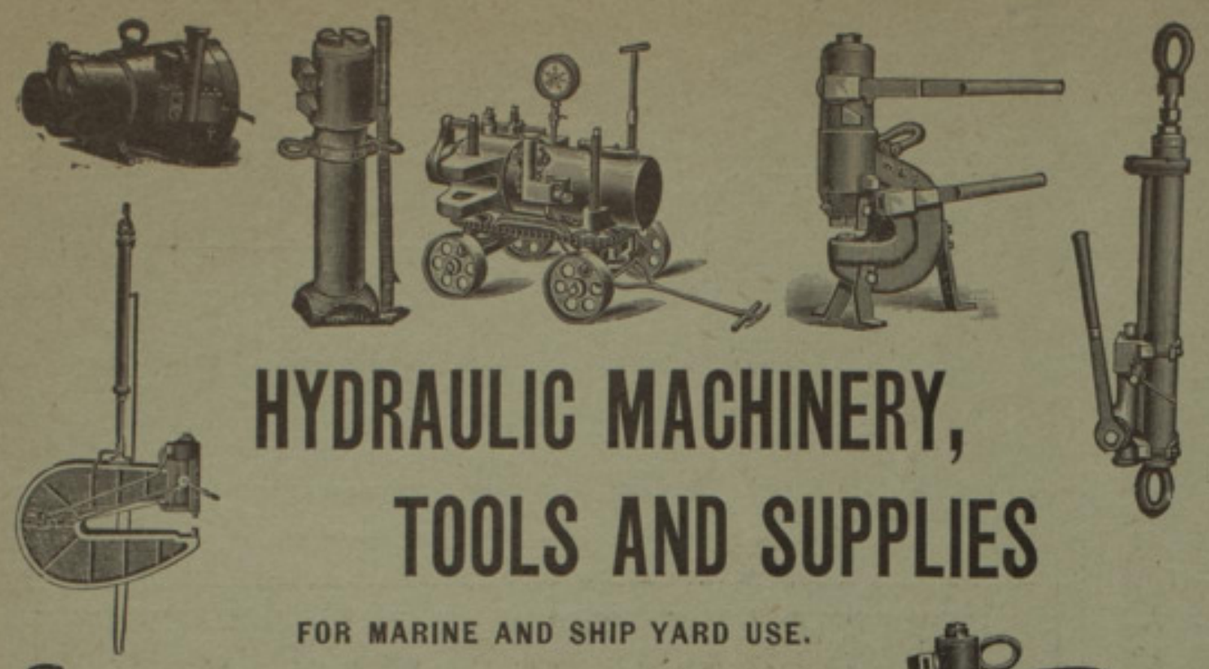

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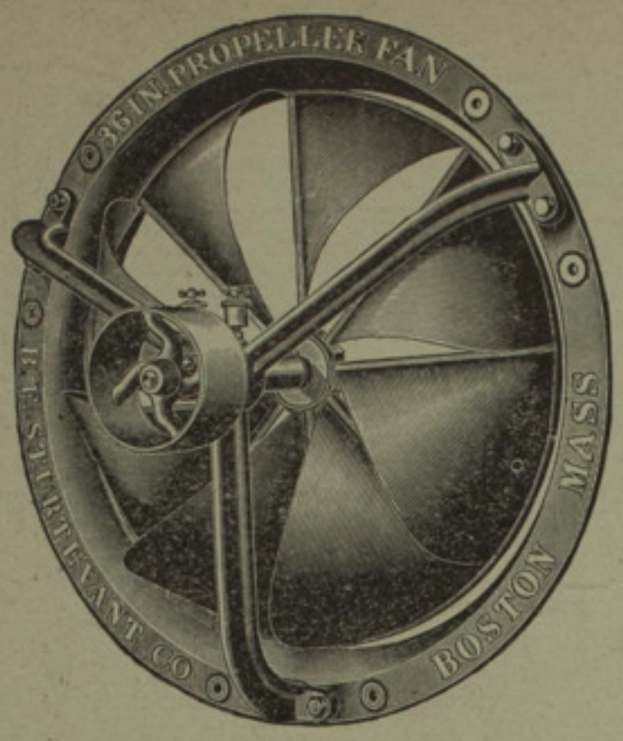

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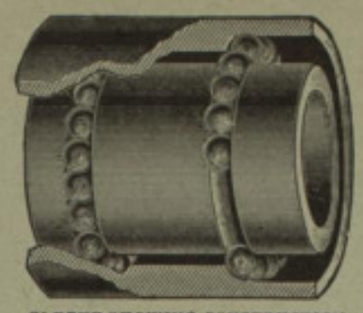

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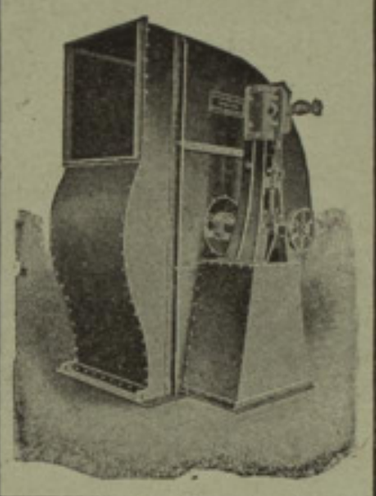

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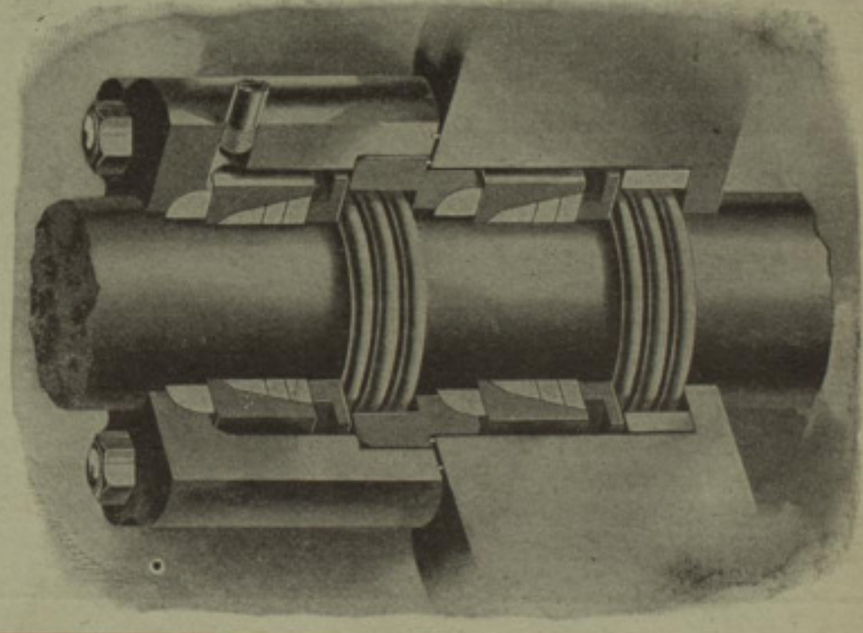

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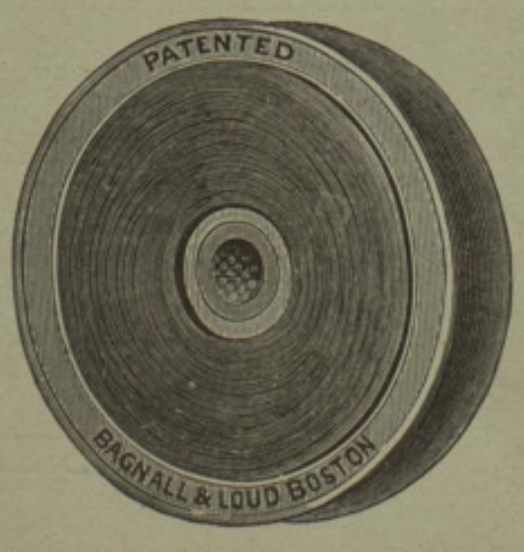

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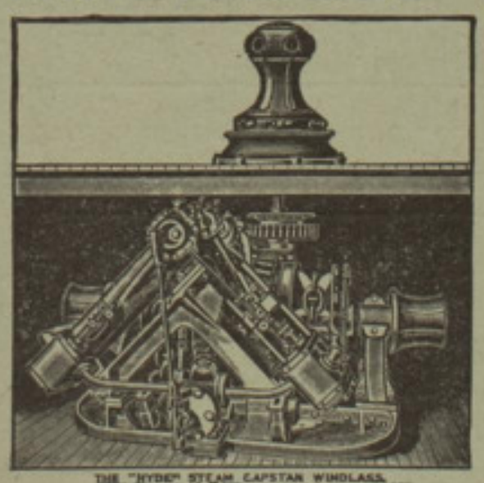

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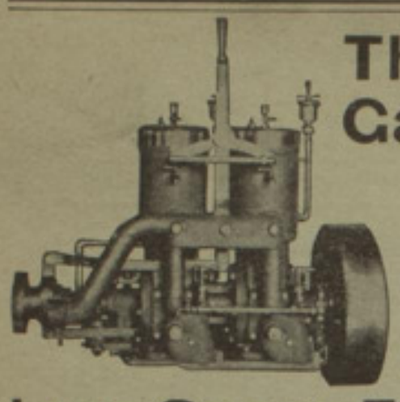

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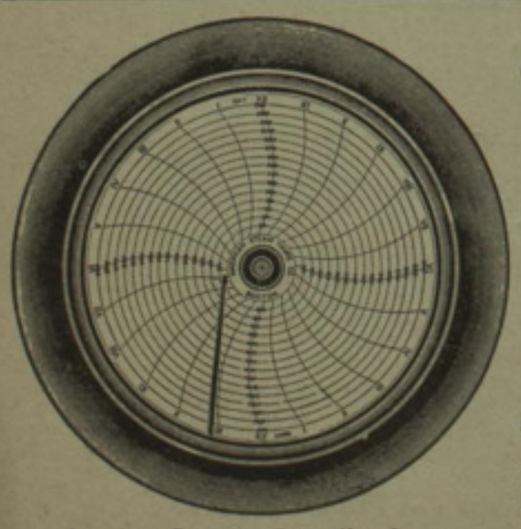

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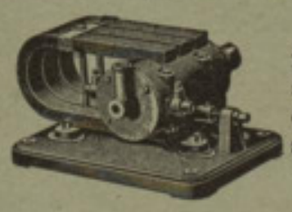

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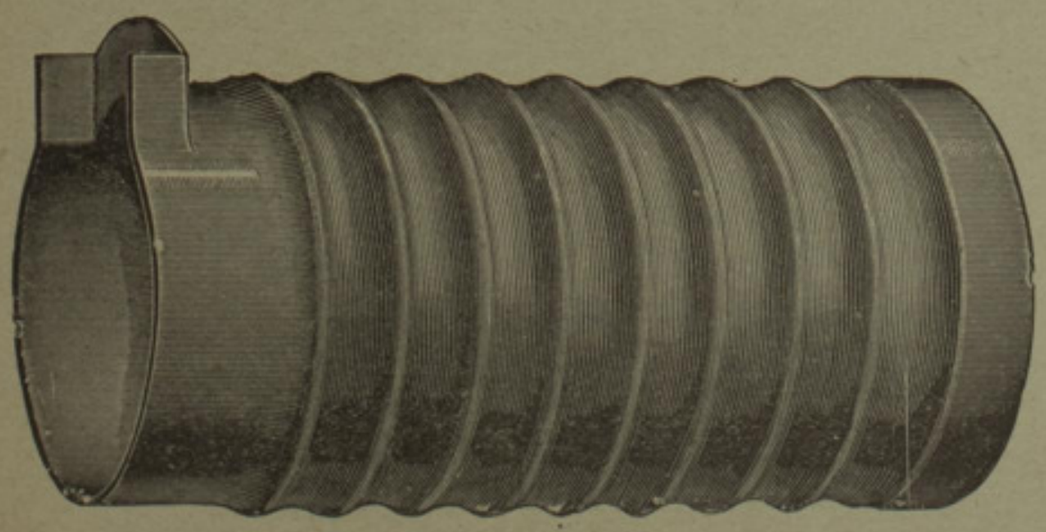

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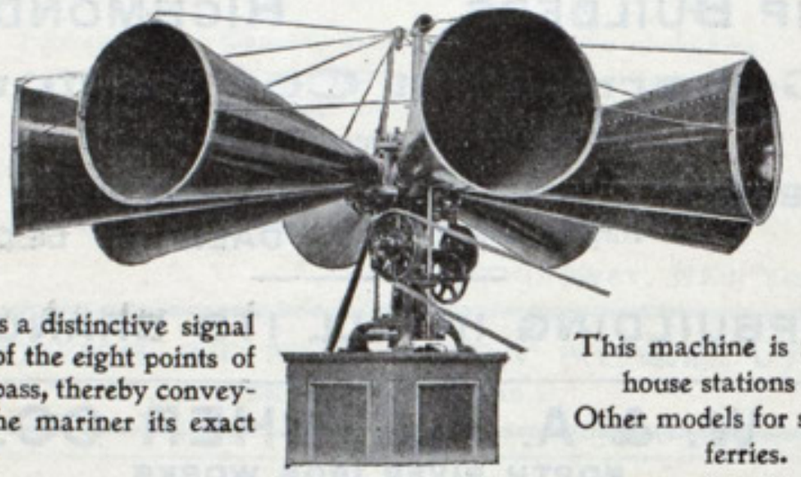

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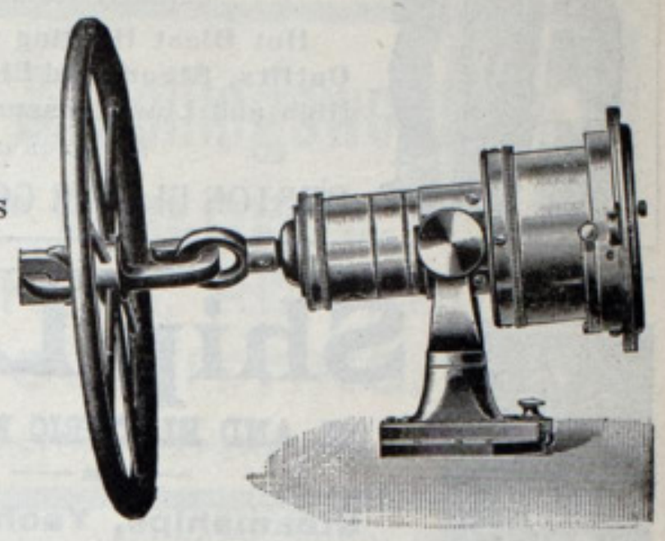

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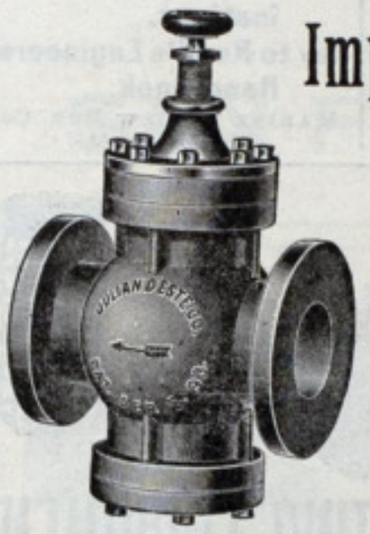

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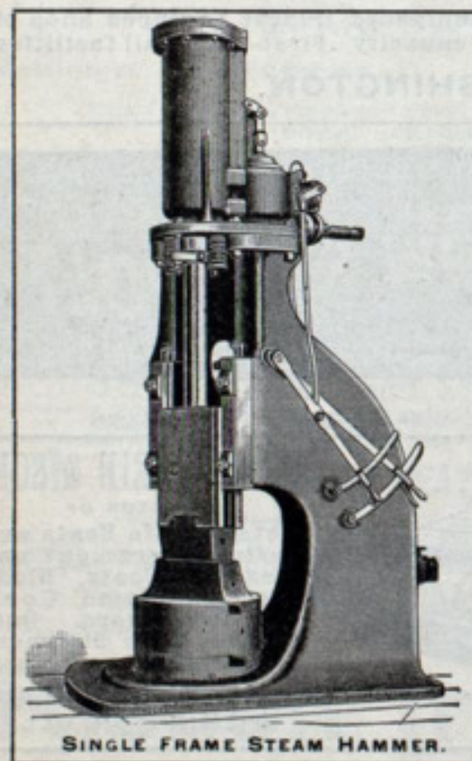

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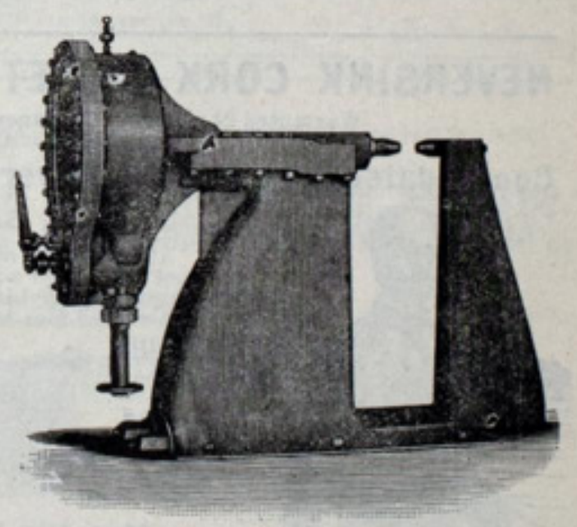

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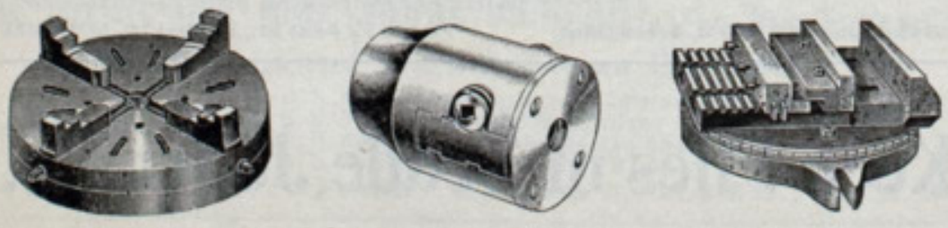

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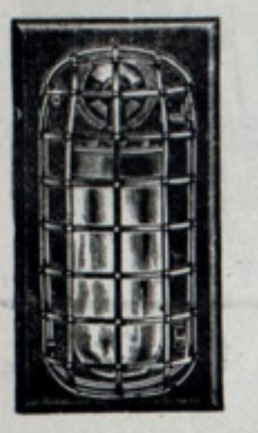

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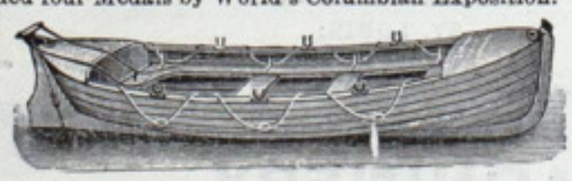

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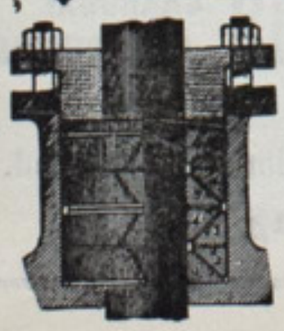

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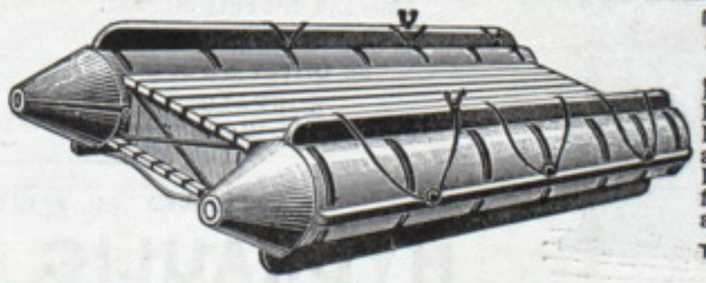

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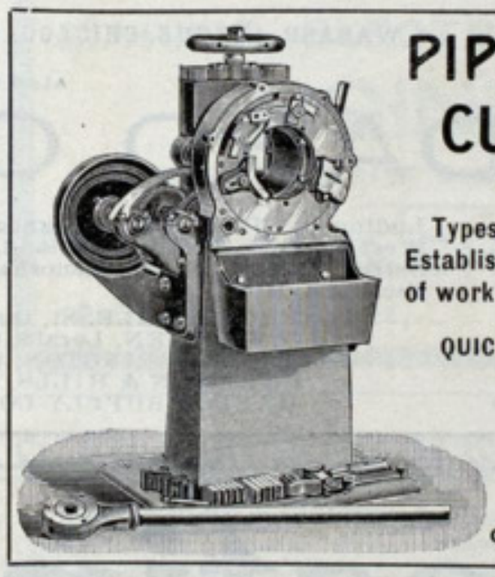

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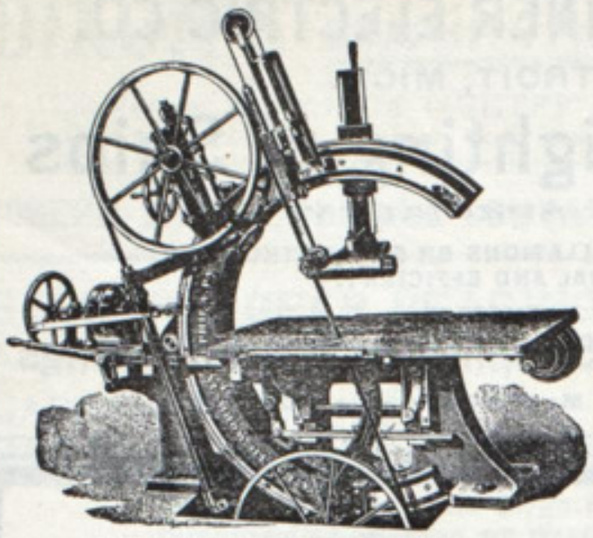

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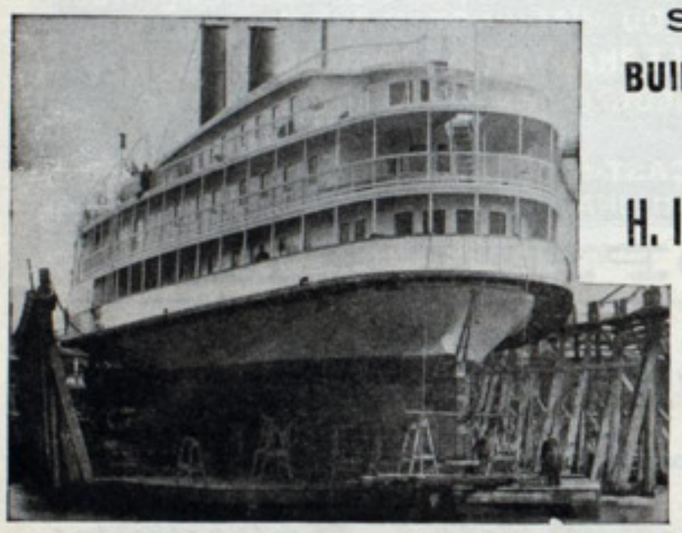

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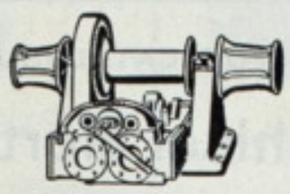

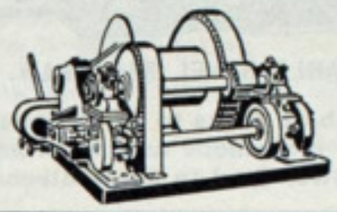

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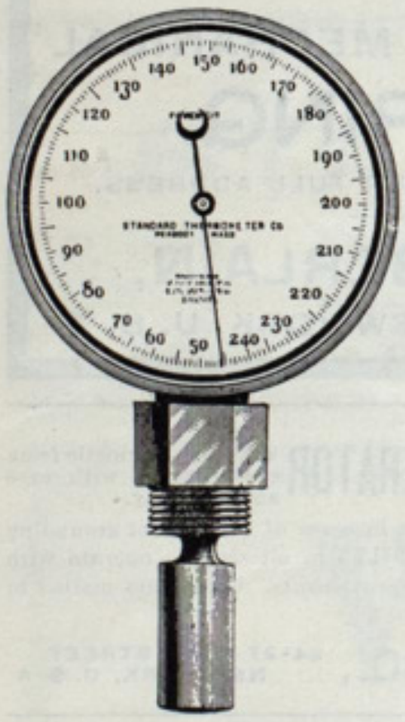

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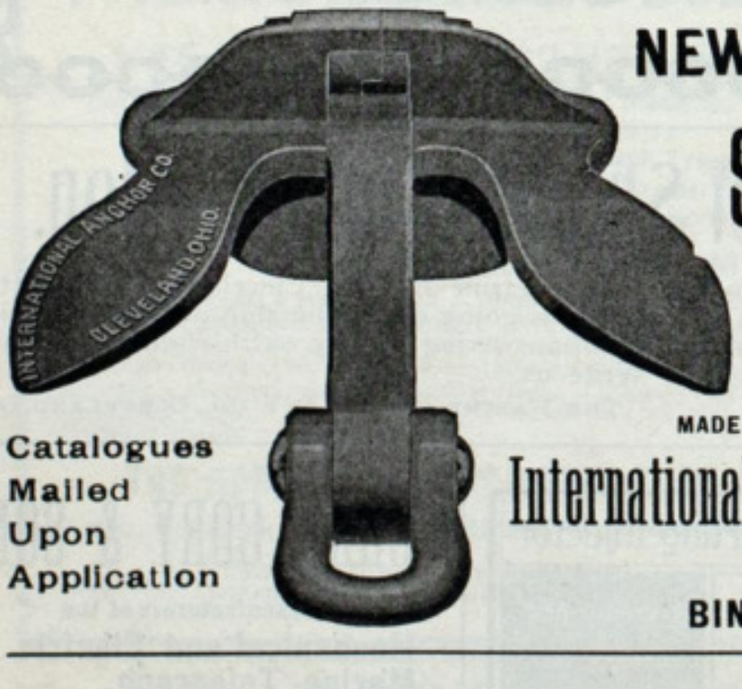

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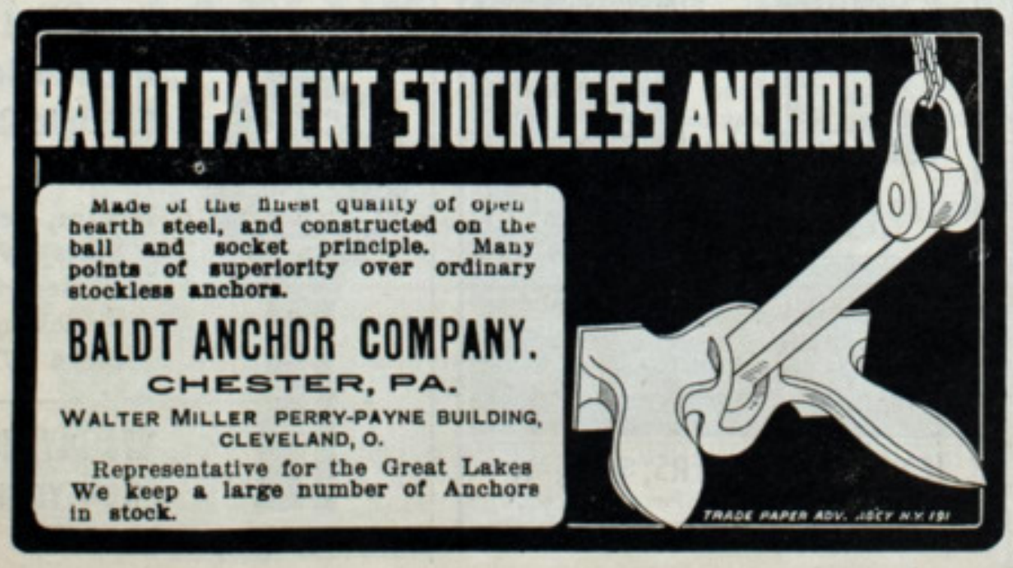

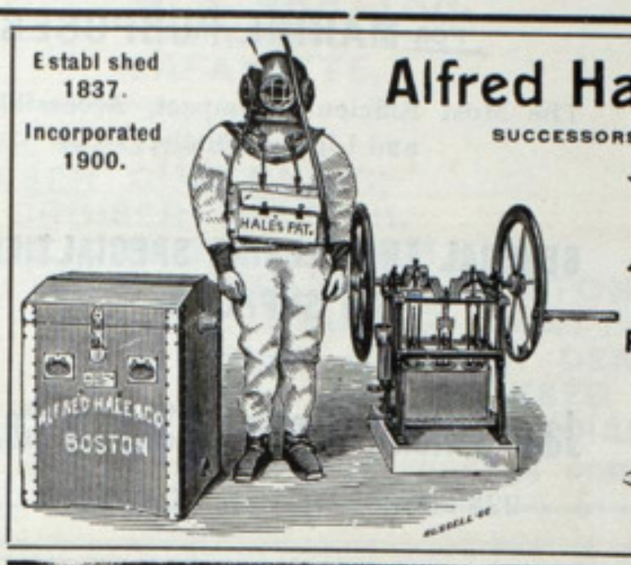

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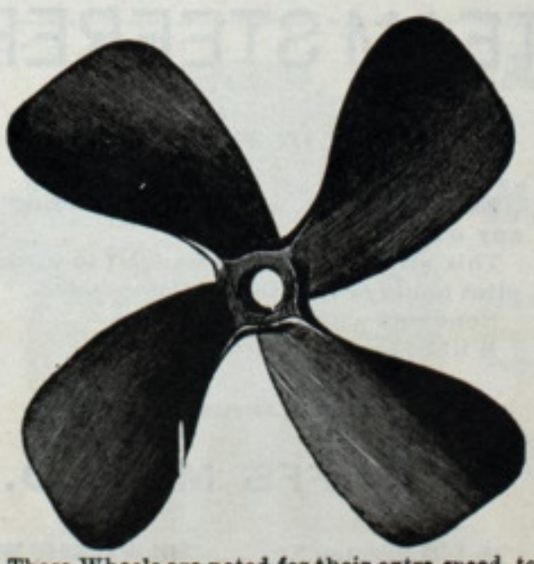

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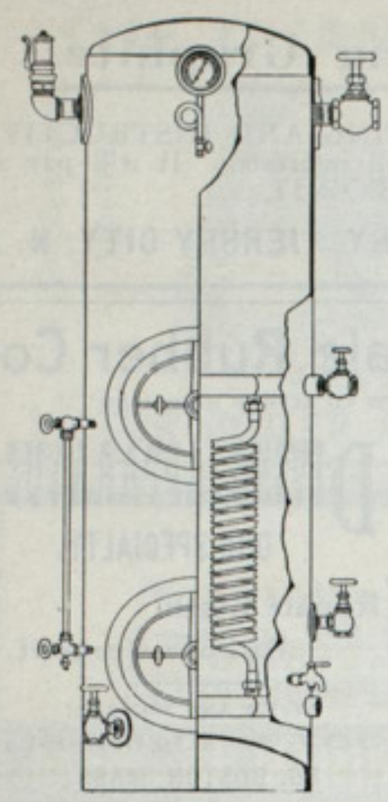

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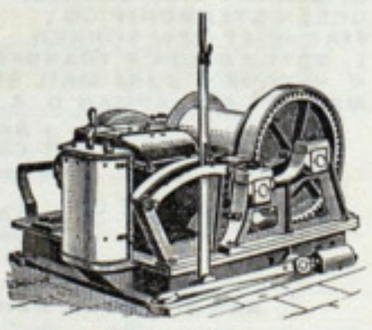

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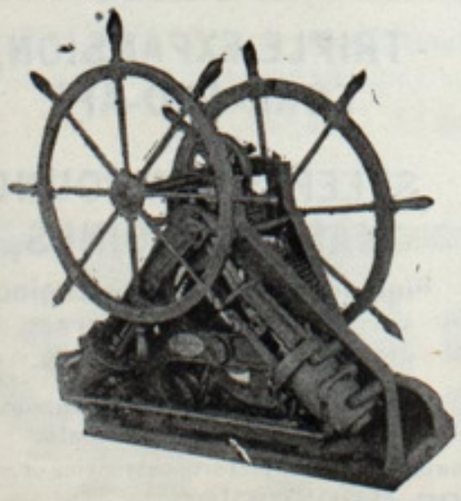

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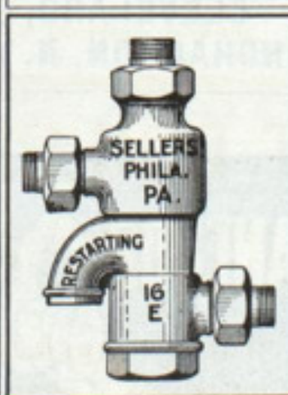

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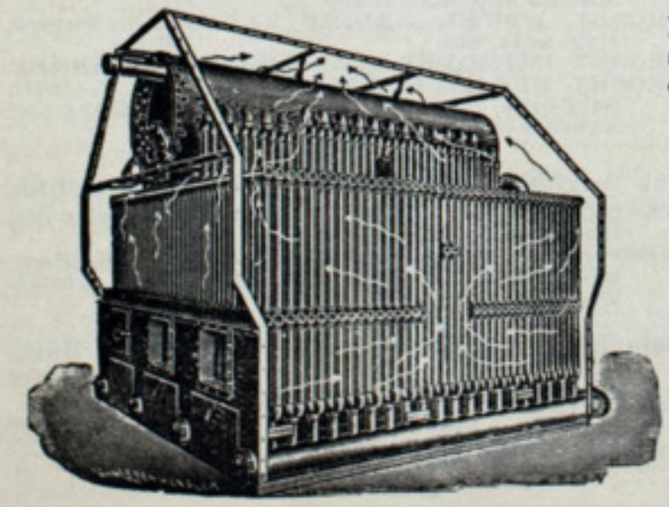

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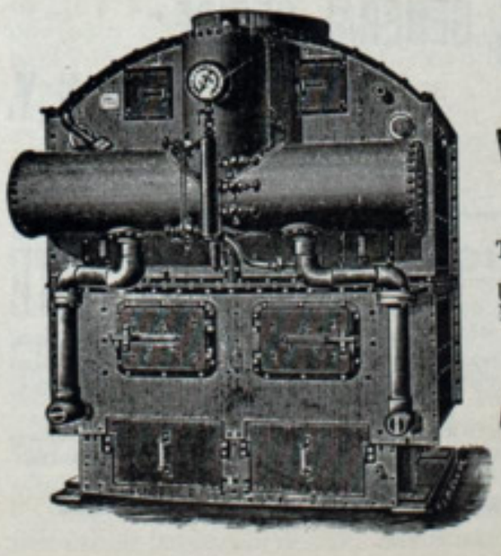

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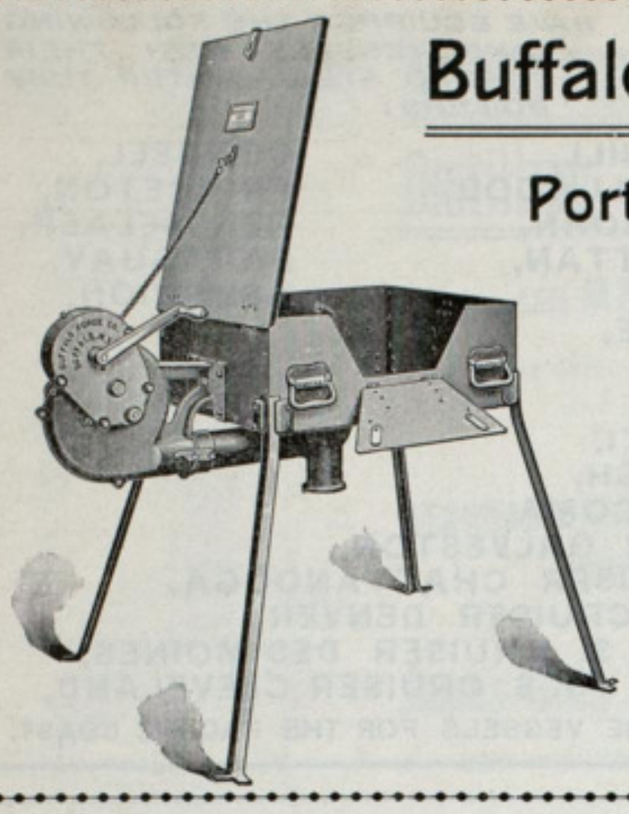

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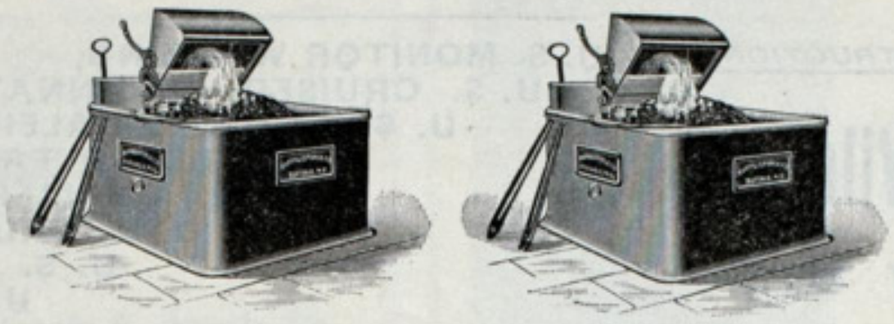

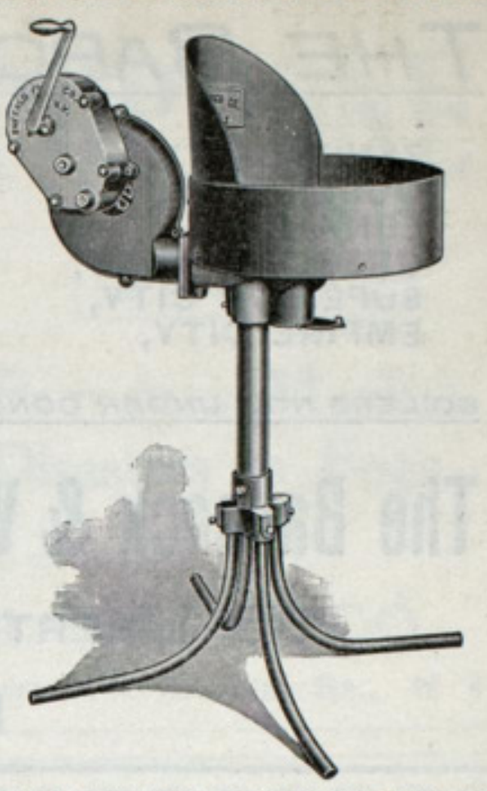

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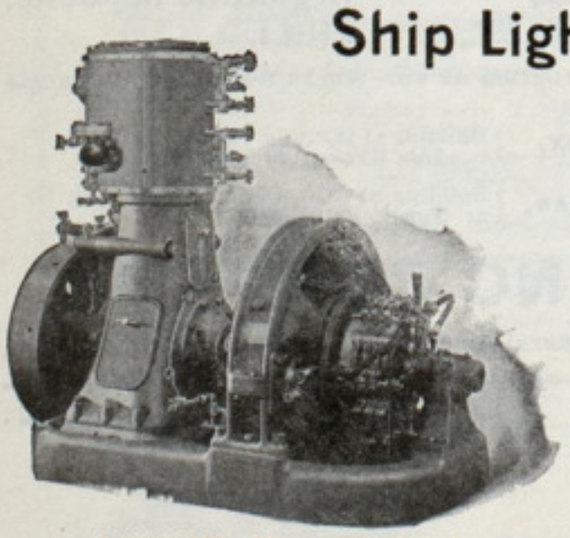

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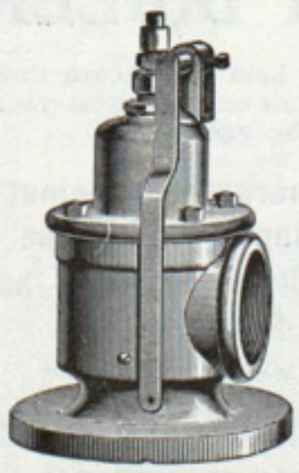

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